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DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS, STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION, BRIDGES.

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The American Water-Works Standard Bookkeeping System

What It Is

It is a comprehensive system of bookkeeping, founded upon the latest and best accountant methods as applied to the needs of Water Companies.

What It Does

It saves time and labor, eliminates unnecessary entries, reduces liability to mistakes, and simplifies the whole method of the keeping of records. **All this saves many times the cost of the books.**

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The American Water-Works Standard Bookkeeping System is based upon a careful study of methods in use by Water-Works Companies throughout the country, and embraces the good features of them all. It is the outgrowth of a competition instituted by Municipal Engineering Magazine, in which prizes were offered for the best set of forms. In response to this call many blanks were received from points throughout the United States and Canada, and after a careful examination of them by a committee composed of F. A. W. Davis, President of the American Water-Works Association (1896-97), William Fortune, President of the Municipal Engineering Co., and Charles Carroll Brown, member of the American Society of Civil Engineers, the prizes were awarded.

NO ONE SET, however, was found to embrace all the good points of others, and many of the better ones were cumbersome in the extreme. These forms were afterward taken in hand by competent accountants and carefully studied, and, after a thorough sifting and pruning, the best features of all were embodied in The American Water-Works Standard Bookkeeping System.

How It Was Developed

(1) A Rated Water Register for flat-rate consumers; (2) Metered Water Register; (3) Special Register; (4) Delinquent Register; (5) Cash Received Book; (6) Cash Disbursements and Voucher Record; (7) General Ledger; (8) Journal; (9) Card Index System.

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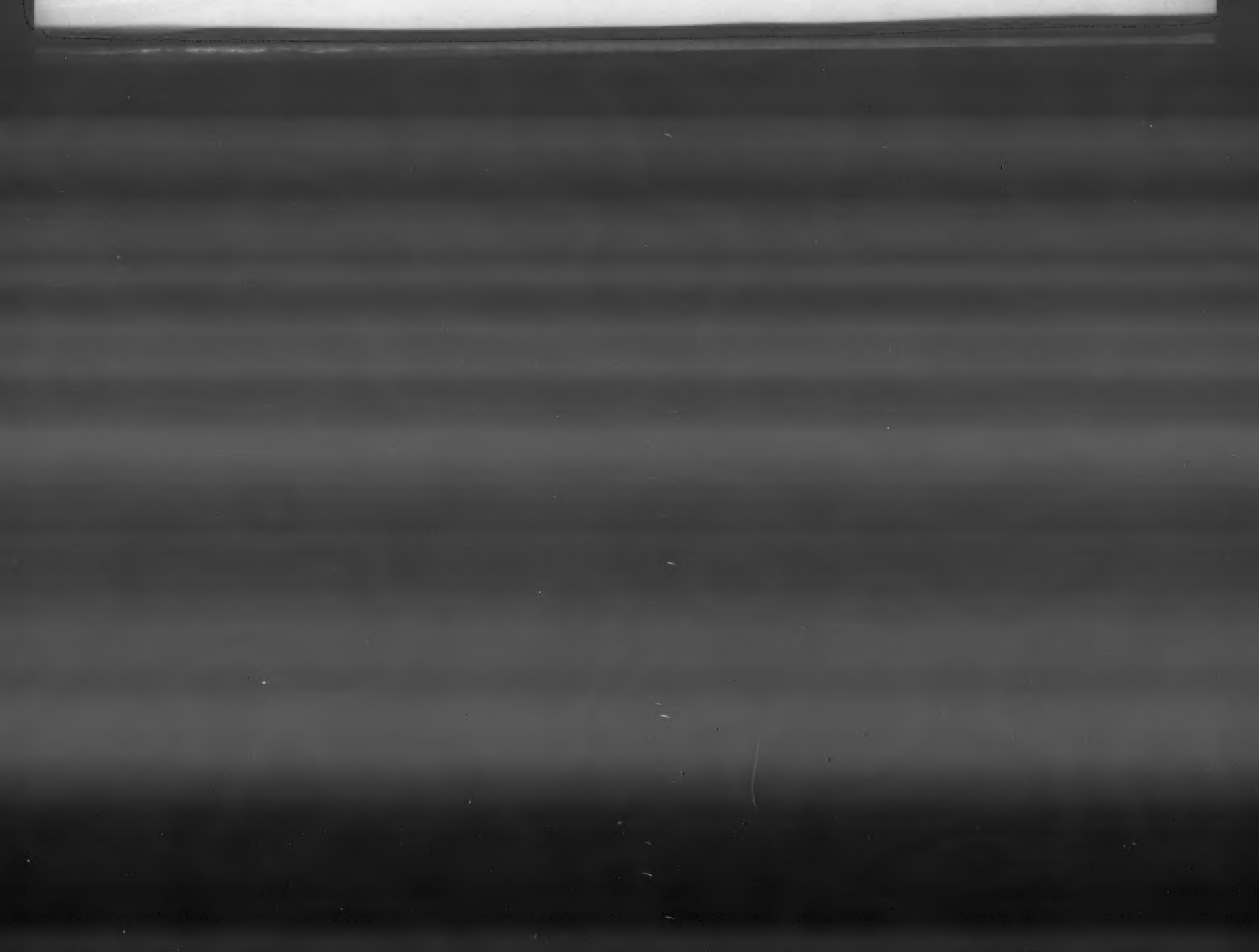
Indianapolis, Ind.



Municipal Engineering

VOLUME XIX. JULY, NINETEEN HUNDRED. NUMBER 1.

INITIAL STEPS IN GETTING GOOD ROADS.

By Daniel B. Luten, Instructor in Roads and Pavements, Purdue University.

There are those who advocate harder roads because of their greater permanence. In attributing greater permanence to the harder road one condition must not be forgotten: that a gravel road, or a stone road, will be more permanent than a dirt road only when properly cared for. No one has ever yet discovered a road that will repair itself.

A dirt road, *provided it could be supplied with exactly the right amount of moisture*, would be a better road for general traffic than the best of stone roads. Unfortunately the amount of water that is supplied to dirt roads can not be regulated; it may, however, be controlled to a limited extent, if the proper means be taken.

FIG. I.

The views of Fig. 1 and Fig. 2 illustrate the possibility of improvement, by proper safeguards, against the destructive action of water.

The views were taken at two points, separated by about 800 feet,

on the University and Western Gravel Road, in West Lafayette, Ind.; they were taken on the same day, with an interval of ten minutes between. Fig. 1 is taken on the level, at the top of the hill, and Fig. 2 on the slope, where the grade was six feet in a hundred.

The road is supposed to be a gravel road, but it is kept in repair, not by the county, but by the town of West Lafayette, and the material used consisted of about thirty-five per cent. gravel, ten per cent. of rocks two inches and upwards, and sixty per cent. fine material, sand and loam, so that it is but little better than a dirt road. The hill and the level had both been repaired with a four-inch layer of the above material, about four months before the views were taken. The mud was caused by rain which had ceased about twenty-four hours before. In both views the right-hand side of the road leaving town is shown, and in both cases the traffic is restricted to the same narrow way by a street railway. The traffic on the hill, of Fig. 2, is heavier than that on the level, of Fig. 1, because of the junction with the Morehouse gravel road at the top of the hill. The road on the level, as shown in Fig. 1, has a slope towards the side of about one-half inch to the foot; but the surface water has been prevented from escaping by the ruts. On the hill, Fig. 2, the slope towards the side is inappreciable, but the slope, longitudinally, is about six per cent., or three-quarters of an inch to the foot. In this case the ruts have assisted instead of barring the escape of the water, and a good road is the result. In short, if the surface water can be disposed of with promptness, a dirt road will become a reasonably good road.

FIG. II.

The prompt disposal of the water from the surface can not be accomplished by underdrainage; subdrains act only after the surface has been softened. The proper solution is careful crowning and

smoothing, and this can be accomplished only by constant attention by a skilled attendant.

Since constant attention is also one of the requisites of a good hard-road system, it would seem as though this feature ought to be the first element to be secured in the adoption of any system of road improvement. The introduction of stone roads, or any class of better roads, is sure to result in waste of money, and a consequent revulsion against the extension of the system, unless proper means are provided for their continued maintenance. An attempt to introduce stone roads of expensive construction is a laborious and thankless task, and one that is sure to meet with opposition from the farmers that usually proves overwhelming.

Estimates of the waste occasioned by bad roads, the increased capacity of traffic on good roads, and all the other arguments used by good-roads educators are well-nigh useless in convincing the man who has to pay the cost of construction that stone roads are a necessity. The reason is that the introduction of stone roads at the present time is not a natural solution, but a forced one, and is accepted against the wish of many of the farmers benefited thereby. It is useless to argue that the securing of good roads is an end that justifies the means. The method in this case requires too great exertions on the part of a few, and involves too many discouragements and failures to be considered a rational solution of the road problem. If stone roads are to be desired, they must be secured by some other method than expensive construction and subsequent deterioration.

FAIRFIELD ROAD, IN ESSEX COUNTY, NEW JERSEY. BOULDERS BEING LAID FOR TELFORD BOTTOM OF FIVE INCHES, WITH THREE INCHES OF MACADAM.

On the other hand, the constant-attendant system, while essentially a system of maintenance, at the same time provides for gradual im-

provements, with a consequent rational, healthy growth towards a system of harder roads.

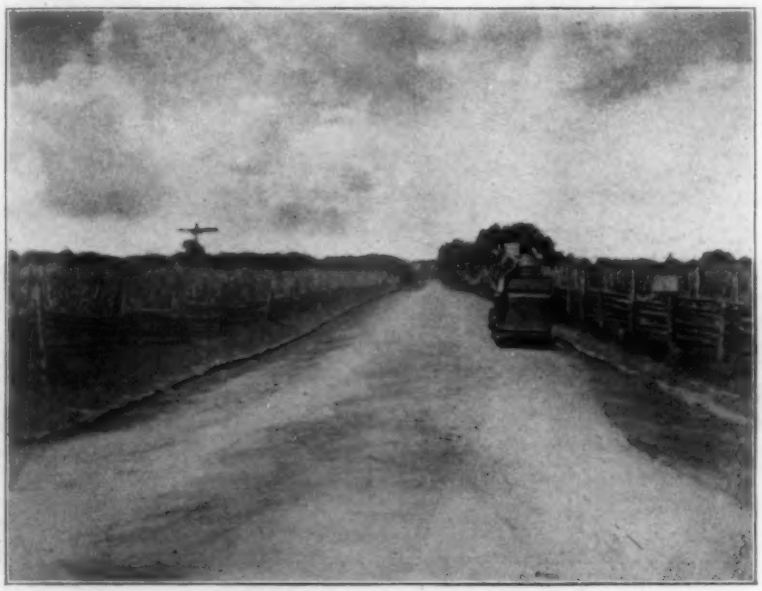
Instead of having the roads repaired by piling them hub-deep with material once a year, they ought to be repaired from day to day, by an attendant who might thus care for a section of from five to twenty miles in length, according to available funds. The ruts and chuck-holes should be filled as soon as they appear, with the hardest material available; the road will thus be gradually transformed into a harder road without the danger of losing the whole of a newly-constructed road by having it churned to pieces in wet weather, or raveled to dust in dry weather in a climate to which perhaps it is entirely unsuited.

FAIRFIELD ROAD, ESSEX COUNTY, NEW JERSEY, AFTER COMPLETION OF TELFORD MACADAM PAVEMENT.

The constant-attendant system is a system of gradual improvement that develops the sentiment of the public for better roads, at the same time that it supplies the better roads; and that educates experts to maintain and improve them at the same time that it develops the need for such experts. The kind of expert required for our highways is one who understands local conditions and who is willing to give his services at a low salary. Such road experts are not developed by the present system. They do not exist. They can be trained by hiring day laborers to attend to the particular problems of a section of road, as section hands are trained on railroads. Expert engineering knowledge is not even desirable; it is too expensive. It is too apt to demand more than a steady growth; on account of its expense it is almost sure to be discarded after new roads have been brought to completion, and thus neglects what is of far more importance than construction—the maintenance of the road. With all due respect to county surveyors and civil engineers, I believe that bad roads will be made good by the

man who handles the shovel and the scraper, and not by the man who attempts to improve them by running grade lines and by drawing elaborate plans of construction. Until our roads shall have been vastly improved, the engineer is a superfluity.

Our roads will in time be developed into a system which will require engineering superintendence for its economical administration of the road work, as is now more frequently the case. Reported defects would receive far more attention from a man whose livelihood depends upon the attention he gives to his section, than from one who devotes but a few days in the year to improvements under a leader who rarely understands the nature of road improvements. Be it understood that the writer does not blame the present road officers



OLD YORK ROAD, BURLINGTON COUNTY, N. J., LEADING FROM BORDENTOWN TO GEORGETOWN, SIX-INCH MACADAM.

tion; and when that time comes the people will have a sufficient appreciation of their value to pay them the salary their services deserve. For the present, however, the county officer, who is now in charge of the roads, should be the man to superintend the attendants under the proposed system. Each and every resident farmer on the section would then be in part an employer of the attendant and would help to keep him to his duties, instead of neglecting his portion for incapacity; the fault is in the system that makes no one a responsible road expert.

It has been found possible in certain localities to get the farmers to co-operate to build several miles of stone or gravel road, at an expense of thousands of dollars, a large part of which is invariably thrown away by subsequent neglect. It ought not, therefore, to be a difficult matter to secure the cooperation of farmers in having an attendant to care for their section

of from ten to twenty miles, at the same time gradually improving it; more especially as the latter method would require far less material, and would have the added economy of employing labor by the year instead of by the day.

The writer is a firm believer in the necessity for harder roads, but he believes that they should be obtained by a system that will keep everything it gains, and that, while taking a step forward, will also make the most of present conditions. This the constant-attendant system will do. State aid, engineering superintendence, wide tires, etc., would follow as a logical sequence, but should not precede it. The constant attendant is the basis of every successful road system in the world. It is a part of the French system, of the German, English and Swiss systems; even Porto Rico has it. It is a necessity to any substantial system.

It offers opportunities for beautifying the roadway that no other system can even contemplate, because of public opposition to direct appropriations for ornamentation. It decreases the number of votes that can be commanded by the patronage of public road officials. It would train a class of practical road experts. It would reduce the opportunities for idealists to clamor for appropriations for building military roads, and for advocating transcontinental avenues two or three hundred feet wide. It would train public sentiment to an appreciation of good roads. It would introduce hard roads slowly, but without the opposition that at present defeats such improvements. It offers, in short, a rational, logical method of road improvement.

WHITE HORSE ROAD, NEAR TRENTON, N. J., FOUR-INCH MACADAM, BEARING HEAVY TRAFFIC.

THE BOOKKEEPING OF PUBLIC SERVICE INDUSTRIES.

By C. W. Tooke, Professor of Public Law, University of Illinois.

The prime purpose of municipal bookkeeping is to secure successful financial administration; but we must recognize as essential to this end that the system of accounting should be designed to give to the public thoroughly reliable and intelligible information of the financial standing of the enterprise from a strictly business point of view. The only way in which this result can be obtained is to treat the public service industry strictly as a private industry for all purposes of municipal bookkeeping. Every element of expenditure, both under the revenue account and under the capital account that a private company must take into consideration, should be included in making up the statements of the cost of service. Not only should the interest on the entire investment, the insurance against loss by accidents and against the impairment of the investment be taken into account, but the industry should either be subjected to state and local taxes or the amount of these taxes relinquished should be taken into consideration in ascertaining the annual expenditure.

PENNINGTON AND TRENTON ROAD, MORRIS COUNTY, N. J., SIX AND EIGHT-INCH MACADAM, BEARING HEAVY TRAFFIC.

Another obvious consequence of this method of treatment is that a separate account should be kept for each public service industry operated by a municipality. The expenditures for materials and for salaries and wages of employes should be truly and accurately charged to that department for which they are incurred. No department should enjoy free service at the expense of another, but all services

rendered should be credited at the prices determined to the department supplying the same. These suggestions are among the simplest principles of correct bookkeeping and their adoption would avoid the concealment of the true financial condition of the enterprise—an evil in American methods which in some instances has been notorious.[1]

To some these suggestions may seem to be radical, but I would call attention to the fact that they are generally observed in all the English municipalities and in many of those on the continent. If we open, for example, the annual report of the treasurer of the county borough of Bolton, a town of some 120,000 inhabitants, which owns and operates among other industries its water-works, gas plant, electric lighting plant and tramways, we find that the revenue account in each case includes the borough and poor rates, the property tax and the income tax on profits; and that a separate account is kept for each industry operated by the municipality, the report of which shows at a glance the exact financial state of the enterprise in question.[2] As to the efficiency of the administration of these industries it may be well to note in passing that for the last eight years the average profit of the water department has been over £11,000 and that of the gas department no less than £18,500.[3]

DENVILLE AND PINE BROOK ROAD, MORRIS COUNTY, N. J., BEFORE IMPROVEMENT.

Such a system of bookkeeping has the further advantage, which I deem of paramount importance, of furnishing a reliable basis of com-

[1] See the brochure of L. S. Rowe, "The Municipality and Gas Supply," published by the American Academy of Political and Social Science.

[2] "Abstract of Treasurer's Accounts for Year 1897-8." See appendix II.

[3] "Municipal Year Book of the United Kingdom, 1898," pages 38, 39.

parison between the operation of such industries under public and under private ownership. I desire to emphasize this point because I believe that upon the proper solution of this question will depend the success or failure of municipal ownership in this country in the next twenty-five years. Advocates of public ownership on the one hand and supporters of private ownership on the other are coming to agree that the interest of the people of our municipalities is the sole criterion by which the franchise question should be settled.[1] The difference of opinion as to the relative efficiency of the two systems is largely due to a difference of judgment as to the force of the evidence presented, and both parties freely admit that the evidence available to-day is inadequate to any scientific determination of the question upon its merits.

The practical statement involved in this contention is that all companies operating under municipal franchises should be compelled to keep similar accounts and to make annual reports to the state authorities. There is no valid reason why the same state authorities should not exercise a control in this respect over all public service industries, whether operated under private or under public ownership. That private companies should seek to conceal from the public the true state of their business is natural, but the time has come when for the public service industries under discussion such concealment should no longer be regarded as permissible. The interests of the people are so directly concerned that publicity of accounts, systematically and correctly set forth, must in the

DENVILLE AND PINE BROOK ROAD, AFTER IMPROVEMENT, SIX-INCH MACADAM.

[1] See the testimony of M. N. Baker in his article on "Water-Works," in "Municipal Monopolies," page 50; and that of Allan Ripley Foote in "Municipal Public Service Industries," page 214. The investigation now being conducted by the United States Department of Labor will doubtless throw much light on this question.

near future be required of all companies operating under municipal franchises. The interests of the stockholders of the private corporations as well demand a like control to prevent undue interference by the local authorities, and to enable the companies to operate their plants to the best advantage.[2]

[2] See "Review of Danville Water Case," in MUNICIPAL ENGINEERING, September, 1899; also, "Municipal Monopolies," page 60, by E. W. Bemis.

AWARD OF PRIZES FOR ACCOUNTING FORMS OF LIGHTING COMPANIES.

In response to the competition announced in these pages for the best set of accounting forms adapted to the use of electric and gas lighting companies, a large number of blanks have been submitted by representatives of such companies in various cities of the country. These blanks have all been carefully examined and their individual and relative points of merit have been fully considered and weighed one against another. It was no simple task to determine which of the many good sets should be chosen as the best. None of them were found to be theoretically perfect, and the poorest were not without features of merit which might with advantage be adopted by others. Several of the competitors seem to have misunderstood the scope of the announcement, as they entered blanks which could not properly be considered under its terms, although they were not entirely irrelevant.

MINE BROOK ROAD, SOMERSET COUNTY, N. J., THROUGH HEAVY CUT, ROUGH ROCK BOTTOM, SIX-INCH, FACED WITH FOUR-INCH MACADAM.

The determination as finally arrived at, in view not only of the forms under consideration, but the

terms of the competition governing the award of prizes, is as follows:

For the best and most complete set of forms for use in conducting the business of an electric lighting company suited to cities under 50,000 population—Thomas F. Bechtel of the Edison Light Company, Grand Rapids, Mich.

For the best and most complete set of such forms, for use in conducting the business of a gas-lighting plant suited to cities under 100,000 population, Jas. R. Shutz, Trenton Gas and Electric Company, Trenton, N. J.

For the best and most complete set of forms for use in conducting combined lighting, water and power plants, Thomas F. Bechtel, of Grand Rapids, Mich.

For the second best set in the first class, A. H. Purdy, of the Edison Electric Illuminating Company, of Topeka, Kan.

For the second best of such forms in Class 3, L. A. Dillingham, Superintendent Board of Water-Works and Electric Light Commissioners, Coldwater, Mich.

The forms submitted by Mr. Jas. R. Shutz, of Trenton, deserve more than an ordinary and passing mention, inasmuch as they were more complete and comprehensive than those of any of the other competitors, and were, besides this, prepared with such particular neatness and care for the examination of those to whom they were submitted.

These blanks, as well as others, will be described in detail in subsequent issues of this magazine, and it is believed the result will prove both interesting and profitable to the many companies who have shown an interest in the subject.

THE RELATION BETWEEN THE GEOLOGY OF THE SOURCES OF WATER SUPPLY AND DISEASE.*

By Marsden Manson.

During the past few years the writer has had occasion to visit various parts of California, and the idea presented itself that it might be desirable to ascertain as far as possible certain facts with regard to the water supply and filth diseases of the various towns. Time did not permit of gathering more than a general idea of local conditions, so the opportunities for getting detailed or extended data were not favorable. The main impressions derived from these notes are presented now in crude form with the hope that interest may be awakened in the subject, and that other members of the profession may extend this examination. At some future time the writer may be able to give the results in more detailed form, and to present features which can not now be discussed.

The mode of procedure was simple, and consisted in an examination of the supply, closely questioning those in charge and visiting and questioning the local physicians, who in all instances gave valuable information. To these gentlemen; and particularly to the physicians, the writer is much indebted. It soon became apparent that there was a certain recurrence

* Read before the Technical Society of the Pacific Coast. Published in Journal of the Association of Engineering Societies.

of special types of disease in widely separated localities, and that some similarity in the water caused this recurrence. Certain diseases not especially recognized as water borne were first noted. Water-borne diseases are notably from organic contaminations, and sewage influences dwarf all other sources of contamination; yet the cumulative effects of mineral impurities can not be neglected.

The geology of the source determines the nature of these impurities, and influences the mode and rate of organic contaminations; it therefore becomes an important factor in water supply. It has long been known that a deficiency of bicarbonate of lime in domestic water was not desirable for infants and growing youth, which deficiency has to be remedied by the addition of lime-salts to give sufficient material for bones and teeth; also that this water was desirable for adults and elderly people; instances of this are Portland, Ore., and Glasgow, Scotland. An excess of this salt can readily be utilized or eliminated in youth, but induces certain diseases of the joints and urinary organs and the deposition of lime in the tissues in middle and latter life.

Between these wide extremes there are many delicately balanced conditions not always readily recognized, but becoming apparent after long use when carefully studied. In many parts of California water is too dear a necessity to criticise from a sanitary standpoint, unless it is so dangerous as to cause an excessive death rate; and even then most communities are content to await the fortunate return of favorable conditions rather than incur any expense in correcting the evils. Again, the diseases are sometimes so insidious that they become apparent only to the observing physician of long practice. Interesting instances of this will be given later.

HANOVER AND AFTON ROAD, MORRIS COUNTY, N. J., SIX-INCH MACADAM.

It will be necessary also, before taking up special types, to refer to the very marked difference between the geology of the Sierras and that of the Coast Range, and of the influence of this difference upon the water from each. The Sierras are

principally granites, syenites, the harder slates, silicious rocks and insoluble lavas. The Coast Range is composed of much softer rocks, which contain more soluble mineral matter, particularly salts of magnesia, soda, lime, alumina, etc.

These differences are further intensified by the greater precipitation upon the Sierras having leeched out the soluble salts and cut down the streams into harder materials.

BURLINGTON AND MT HOLLY ROAD, BURLINGTON COUNTY, N. J., SIX-INCH MACADAM, FOURTEEN-FOOT ROAD.

In each range there are also localities which partake of the nature of the other; thus the northern and central groups of the Coast Range are granitic and yield waters resembling those of the Sierras, and portions of the Sierras yield waters in which there is an abundance of mineral salts.

These differences in geological formation give rise to marked differences in the waters from the two ranges, those from the Sierras frequently having as low as five or six grains of mineral matter to the gallon, and those from Coast Range sometimes contain ten to forty times this amount.

Apart from organic contamination, these latter waters, when highly charged with mineral salts, produce after long use certain types of malnutrition and indigestion, inflammation of the kidneys and bladder, and if deficient in lime, as is sometimes the case, young people, and even children, lose their teeth.

This latter trouble was particularly noted in Owens Valley, where on one side water fairly abundant in lime occurs and on the other side its place is taken by soda, magnesia and alumina, like some of the Coast Range waters. The dentist practicing in this region gave it as the result of years of observation that his practice was principally confined to middle-aged and elderly people on the side

of the valley in which salts of lime occurred, but embraced children as young as thirteen years of age on the side in which lime was deficient.

A similar water was encountered in Vacaville. One of the physicians here, upon being asked about the types of disease incident to the water supply, at once came to the defense of the locality as regards malarial troubles, and fully explained that the few cases occurring were due to special conditions or were "imported"; but when asked regarding the occurrence of kidney or bladder trouble, of which he had had severe cases, admitted that he could account for some of these cases only upon the assumption that they were due to the continuous use of water containing an excess of the salts of magnesia, soda, alumina, etc., and to the weakening of these organs in eliminating these salts.

Water from shallow deposits of quaternary and recent gravels and soils are always dangerous; not by reason of their soluble salts, but for the ease with which these formations permit organic contaminations to pass through them. It does not matter at what elevation above tide they occur, distinct types of disease follow them, partly due to the two causes above mentioned. In low elevations malarial fevers predominate. In elevated regions this takes the form known as "mountain fever," the two being, so far as the writer can determine, analogous.

In some instances, as in many of the foot-hill towns, the purest and best of water is turned out from the streams of the high Sierras and conducted along slow-flowing ditches in surface soils and stored in shallow surface reservoirs of recent geological formation, and hence favorable to organic contamination. The result is that persistent cases of low gastric fevers and diarrhea occur every autumn, due directly to organic contamination, but augmented by geological formations traversed and utilized. This is the most universal type of abuse of good water that one comes in contact with throughout the state, except the direct contamination of the soil adjacent to surface waters used for domestic purposes.

It is very difficult to convince the general public using these supplies of the evils of these contaminations. No more fertile field is open to the engineering profession than a systematic endeavor to bring before the people simple and practical means of correcting these gross violations of the laws of cleanliness and health. The degree of ignorance and prejudice to be encountered is great, and to be successfully overcome will need the aid of the universities and of the legislature.

Water from deep gravel and sand is generally free from dangerous organic impurities, but is likely to be heavily charged with mineral salts; where a change has been made from one source, surface supply, to deep strata or artesian water, a change in health has occurred. An attempt was made to trace the effect of this change through the introduction of those diseases incident to an increase of mineral matter, but this attempt was not successful, although two localities were found where the conditions might be considered favorable. Full data for the determination of this interesting point are not now available, and the scattered data which could be given would probably be misleading.

The kindred subject of the great improvement of health by the in-

troduction of better water supply was frequently noted, but is foreign to the immediate subject of these notes.

A marked instance of the influence of the geological formation in affording very favorable conditions for correcting the effect of contamination was noted in Chico.

The case was simple enough when once traced, and really amounted to nothing more than changing the intake of a pipe above the source of contamination, which, if occurring above ground, would be considered a simple and common-sense remedy; but occurring in this case underground, in a slow-flowing, broad stratum of water, in coarse sand and gravel, and having caused years of sickness and a rich harvest to the medical profession, it becomes of more than passing interest. Besides, it affords a valuable lesson to those whose stupidly set notions will not permit a proper regard for the health of a community to interfere with their income.

The town of Chico is situated on the east side of the Valley of California, near the base of the foothills. The valley slopes gently to the west. The soil is a sandy loam, under which exists a gravelly stratum carrying an excellent quality of water, easily tapped by reason of its uniform distribution, and affording, by reason of the simplicity of the formation, ready means of disseminating contamination.

The water supply was, until some years since, obtained by tapping this stratum at the western or lower edge of the town and pumping it into elevated tanks, from which it was distributed by pipes. Fecal matter was, and is now, disposed of in pits sunk into the porous soil, and when full or clogged up, a new pit was dug adjacent to the old. To such an extent has this been carried that in some backyards nearly every part has been contaminated.

As a natural result the water supply in the stratum below became grossly contaminated, and for years the health of the town was extremely poor. The death rate was not abnormally high, but the occurrence of insidious forms of gastric diseases was excessive. One physician stated that his monthly cash receipts were about $1,800, besides accounts, which were slowly collected or delayed indefinitely.

Finally the intake of the waterworks, or the pump, was shifted to a new well on the eastern or upper side of the town, and these diseases disappeared as if by magic. The physician whose monthly receipts were $1,800 had a decrease which reduced him to $800 a year, although he still attended the same percentage of sick which he previously had, only the number of patients which required the attention of the medical profession was reduced by eleven out of every twelve sick. This, as partly explained above, was due to the simple expedient of changing the intake to a point above the contamination, but, being underground and out of sight, it took years to convince the people of the necessity of the change, and in the meanwhile thousands of cases of sickness occurred each year for the want of a common-sense view of the geology of the locality and its influence on the rate of pollution of the water supply.

The geological formations of the great valley of California are very interesting to study, especially in their influence upon the water supply.

The strata of this valley are complex, and are only known from the

deep borings made in groups, particularly in the southern half. These when platted show that there is a semblance of stratification, and that the strata alternate in clays, sands, gravel and even cobblestone.

This depression in the crust is filled up in places for more than half a mile with these alternating layers. An approximate estimate of the volume between bedrock and the 400-foot contour above sea level shows that certainly four, and probably six or eight, thousand cubic miles of material has been denuded from adjacent water-sheds.

The borings into these strata yield waters of very widely varying character. Those near the surface are generally dangerous, from organic contaminations. Those from a few hundred feet below the surface are ordinarily good.

From depths of a quarter mile, or even less, they are sometimes charged with mineral matter to such an extent as to render them unfit not only for domestic purposes, but even for irrigation. At these depths, however, they hold another mineral ingredient, light carburetted hydrogen, in such abundance that it is collected as natural gas in Stockton and Sacramento, and largely controls the price of fuel and light in these cities.

A very abundant class of waters can not be more than briefly referred to, namely, "mineral" waters. These are numerous, and of great variety; some highly valuable for medical properties, others useless, or even dangerous. The springs occurring along the great fault from Kern county into Nevada and Oregon, and others near faults or recent lava outbursts, are frequently hot or boiling. They are sometimes charged so highly with mineral matter that their use, except for periodic bathing, is limited. All of their ingredients and temperatures are controlled by the geological formations in which they occur. The general conclusions were that not only do the geological conditions influence the medical value of waters, but that they have a deeper interest to the engineer in that they directly and indirectly influence the sanitary value of the water. *Directly* by charging the waters with small quantities of certain salts injurious to the human system when continuously used, and by the absence of salts of lime, depriving the system of an ingredient needful in early life. *Indirectly* by affording conditions which render organic contamination more or less easy to accomplish.

These conclusions, it may be said, could not have been predicated before and for any area, but their local application over so broad a field as California is an interesting and useful study. It is by no means as important as the removal or suppression of organic impurities, but it is nevertheless an issue of considerable moment and one the engineer can not afford to overlook.

SPECIFICATIONS FOR PORTLAND CEMENT SIDEWALKS.

The following specification for Portland cement sidewalks is that prescribed for the department of public works of Pittsburg, Pa., Edward M. Bigelow, director of the department of public works, and John Brunner, superintendent of the bureau of engineering and construction. It is printed here because it is the latest revision of an excel-

lent specification, for the convenience of our correspondents who ask frequently for the information herein:

Description.—Pavements of this class shall consist of a foundation of coarse cinder, or broken stone, six (6) inches deep: a layer of Portland cement concrete, three (3) inches thick, and a wearing surface of Portland cement mortar, one (1) inch thick, making the total thickness of the completed pavement at least ten (10) inches.

Broken Stone for Foundation.—The broken stone or cinder to be used in the foundation shall be of approved quality, broken so that the largest dimension of any piece will not exceed three (3) inches, nor the smallest dimension of any piece be less than one (1) inch, and must be free from dust, dirt or other foreign matter.

Broken Stone for Concrete.—Broken stone for concrete shall be a good, hard stone that will not be affected by the weather, broken so that the longest dimension of any stone will not exceed one and one-half (1½) inches, nor the least dimension of any stone be less than one-quarter (¼) of an inch, and must be free from dust, dirt or other foreign matter.

Gravel for Concrete.—Gravel used for concrete shall be washed river gravel of such sizes that the greatest diameter of any pebble will not exceed one and one-half (1½) inches, nor the least dimension of any pebbles be less than one-quarter (¼) of an inch, and must be free from dust, dirt or other foreign matter.

Sand.—The sand shall be of the best quality of coarse, sharp, clean Allegheny river sand, free from dust, loam or other foreign matter, or a sand equal in quality thereto.

Portland Cement.—Portland cement shall be equal in every respect to that described in the specification for "Portland cement."

Water.—Water shall be fresh and free from earth, dirt or sewage.

Width.—The width of the pavement shall be such as the director may specify.

Sub-Grade.—The s shall
pared as specified for "Grag."

Foundation.—The foundation shall be of cinder or broken stone as hereinbefore specified, and shall be drained to the curb ditch by 10-inch by 12-inch stone drains placed every twenty-five feet along the line of the walk.

Concrete.—The concrete shall consist of one part, in volume, of Portland cement, three (3) parts of sand, and six (6) parts of broken stone or gravel.

Mixing Sand and Cement.—The cement and sand, in the specified proportions, shall be thoroughly mixed dry, on a tight platform, with shovels or hoes until no streaks of cement are visible.

Mortar.—Water shall be added to the sand and cement, mixed in accordance with the foregoing directions, in sufficient quantities to produce a mortar of the desired consistency, and the whole thoroughly mixed with shovels or hoes until a homogeneous mass is produced.

Mixing Concrete.—The mortar, prepared as hereinbefore specified, shall be spread upon the platform, the proper quantity of broken stone or gravel, after having been thoroughly wetted, shall then be spread over the mortar and the mass thoroughly turned over with shovels or hoes not less than three (3) times, or until every pebble or piece of broken stone is completely coated with mortar.

Sprinkling.—Water shall be added by sprinkling during the process of mixing if required to secure a better consistency.

Surfaces to be Cleaned and Dampened.—All surfaces on or against which concrete is to be laid shall be thoroughly cleaned and dampened, by sprinkling with water, just previous to placing the concrete.

Spreading Concrete.—The concrete shall be evenly spread upon the foundation, as soon as mixed, in a layer of such depth that after having been thoroughly compacted with rammers of approved pattern it shall not be in any place less than three (3) inches thick, and the upper surface of it shall be parallel with the proposed surface for the completed pavement.

Making Flags.—The slab or flag divisions shall be formed by cutting the concrete clear through, on the required lines, as soon as laid. The space made by the cutting tool shall be immediately filled with dry sand and well rammed.

Size of Batches.—Concrete shall not be mixed in larger quantities than is required for immediate use, and no batch shall be larger than can be made of one barrel of cement with the proper proportions of sand and stone.

Concrete Not to be Thrown from a Distance.—Concrete shall not be dropped from too great a height or thrown from too great a distance when being placed upon the work.

Wearing Surface.—The wearing surface shall be composed of one part in volume of Portland cement and two (2) parts of sand.

Mixing.—The cement and sand in the specified proportions shall be thoroughly mixed dry, on a tight platform, with shovels or hoes, until no streaks of cement are visible.

Mortar.—Water shall be added to the sand and cement, mixed in accordance with the foregoing directions, in sufficient quantities to produce a mortar of the desired consistency, and the whole thoroughly mixed with shovels or hoes until a homogeneous mass is produced.

Laying.—The mortar, while fresh, shall be spread upon the concrete base before the latter has reached its first set, in such

quantities that after being thoroughly manipulated and spread over the concrete it will make a layer one inch thick, conforming to the required grade and cross-section.

Top Dressing.—A coating of equal parts of Portland cement and dry, fine sand, thoroughly mixed, shall be swept over the surface and the surface dressed and smoothed. On steep grades the top dressing shall consist of coarse granite screenings and cement.

Flag Markings.—The surface shall then be cut into flags, the markings to be made directly over the joints in the concrete and cut clear through the wearing surface.

Marking of Surface.—The flags shall then be trued up and marked over, with the exception of a border of about an inch in width along the edges, with a toothed roller.

Protection of Top.—The pavement shall be kept moist and protected from the elements and travel until it has set.

Entrances to be Preserved.—Entrances from adjoining streets or walks to all private or public premises shall be preserved by the contractor.

Cross Section.—The completed pavement shall, unless otherwise ordered, have a rise of one quarter (¼) of an inch to the foot rising from the curb.

Forms.—Board or timber forms shall be provided by the contractor to mold the concrete and mortar to the required shape, and shall be left in place until the concrete or mortar is set.

Retempering Not Permitted.—Retempering of concrete or mortar will not be permitted, and mortar or concrete that has begun to set before ramming is completed shall be removed from the work.

Mortar and Concrete That Has Not Set.—Concrete or mortar that fails to show a proper bond or fails to set, after, in the opinion of the director, it has been allowed sufficient time, shall be taken up and replaced with new concrete or mortar, of the proper quality, by the contractor.

Pavement to be Maintained.—If at any time during the guarantee period any cracks, scales or other defects develop in the pavement, the pavement at that point shall be taken up and relaid with new materials, in accordance with these specifications, by the contractor.

MODEL SPECIFICATIONS AND TESTS FOR CEMENT.

We have received from the Bureau of Engineering of the city of Pittsburg copies of the adopted specifications for the construction of bridges, streets and sidewalks, and wish to call attention to them as a convenient and very nearly complete compendium of good specifications for municipal work of these classes. The requirements for materials are of course adapted to local conditions and are therefore not applicable exactly, as printed, to other cities, but those for workmanship are very generally applicable. The specification for Portland cement seems to be the same for concrete work as for sidewalk work. It will secure excellent cement for the former purpose, perhaps better than is necessary under most conditions, but would admit cements which experience has shown to be inferior for the wearing surface of cement sidewalks. Higher requirements from the cements for the latter class of work should be made either in the specification for strength or in one limiting the brands to be used to those which have proved themselves acceptable in actual use.

The specifications for cement sidewalks, given elsewhere in this issue, will give an excellent idea of the careful manner in which the details of all kinds of work have been worked out by the authors:

Cement—When and Where Delivered.—All cement required on the work shall be delivered at a warehouse within the limits of the city, and the director notified of each delivery, at least two weeks before it will be needed in the work.

Cement—How Stored.—Cement shall be so stored, in a dry place thoroughly protected from rain and dampness, that each shipment is piled to itself and at all times readily accessible for inspection and tests.

Cement from Reliable Manufacturers Alone Accepted.—Cement will be accepted from reliable manufacturers of well-established reputation only, and the cement will not be tested or permitted to be used unless delivered in original packages properly labeled.

Temperatures for Tests.—Tests of the ce-

ment will, unless otherwise specified, be made at a temperature of from 60 to 70 degrees Fahrenheit.

Samples for Tests.—Samples for tests may be taken from every package in each shipment of cement, and unless they meet the requirements herein specified, the whole shipment from which the samples were taken will be rejected.

Sieves for Tests.—The sieves used for testing cement for fineness and for gaging the sand to be used in making briquettes for sand tests shall be as follows:

No. 20 sieve shall have 400 meshes to the square inch, and shall be made of wire cloth, No. 28 wire Stub's gage.

No. 30 sieve shall have 900 meshes to the square inch and shall be made of wire cloth, No. 31 wire Stub's gage.

No. 50 sieve shall have 2,500 meshes to the square inch and shall be made of wire cloth, No. 35 wire Stub's gage.

No. 100 sieve shall have 10,000 meshes to the square inch, and shall be made of wire cloth, No. 40 wire Stub's gage.

Briquettes for Tests.—Briquettes for testing tensile strength of cement will be made both of neat cement and of cement and sand in the proportions hereinafter specified, with only enough water added to thoroughly moisten the mixture and make it coherent.

Making Briquettes.—After being thoroughly mixed on a glass plate the mortar shall be firmly pressed into the molds by hand, and the briquettes so formed placed upon a glass plate and kept there until put in water.

Sand for Briquettes.—The sand used in preparing briquettes shall be, unless otherwise specified, clean, sharp, crushed quartz, crushed so that the whole of it will pass through a No. 20 sieve and be retained on a No. 30 sieve.

Pats for Tests.—Round pats of neat cement, about three (3) inches in diameter, one-half an inch thick at the center and tapering to a feather edge, mixed in the same manner as the neat cement briquettes and placed on a glass plate, shall not show any signs of warping or cracking after twenty-eight (28) days in either air or water.

Cement that Swells to be Rejected.—Any cement which shows signs of swelling, after being mixed, will be rejected.

Fineness of Portland Cement.—Portland cement shall be ground to such a degree of fineness that not less than 98 per cent. by weight shall pass a No. 50 sieve, and not less than 90 per cent. by weight pass a No. 100 sieve.

Tensile Strength of Portland Cement—Neat.—The ultimate tensile strength of briquettes, one square inch in cross section, made of neat Portland cement, shall be as follows:

1 day in air and 6 days in water, 375 pounds.

1 day in air and 27 days in water, 510 pounds.

Tensile Strength of Portland Cement—3 to 1.—The ultimate tensile strength of briquettes one square inch in cross section, made of one part by weight of Portland cement and three parts of sand, shall be as follows:

1 day in air and 6 days in water, 120 pounds.

1 day in air and 27 days in water, 190 pounds.

Fineness of Natural Cement.—Natural cement shall be ground to such degree of fineness that not less than 88 per cent. by weight will pass a No. 50 sieve, and not less than 77 per cent. by weight pass a No. 100 sieve.

Tensile Strength of Natural Cement—Neat.—The ultimate tensile strength of briquettes one square inch in cross section, made of neat natural cement, shall be as follows:

1 hour in air and 23 hours in water, 70 pounds.

1 day in air and 6 days in water, 110 pounds.

1 day in air and 27 days in water, 180 pounds.

Tensile Strength of Natural Cement—2 to 1.—The ultimate tensile strength of briqpettes, one square inch in cross section, made of one part by weight of natural cement and two parts of sand, shall be as follows:

1 day in air and 6 days in water, 50 pounds.

1 day in air and 27 days in water, 80 pounds.

Additional Tests.—In addition to the tests above specified, all cement used on city work shall be subject to such other tests as will be necessary to determine whether the cement possesses the proper qualities for the particular work for which it is designated.

Should there be discovered, at any time, any characteristics in any cement being used on any city work that are objectionable in that or any similar work, the further use of cement of this same brand on all work of the same class will be prohibited, regardless of the fact that it has successfully withstood the tests hereinbefore-specified.

Sand.—Sand for mortar shall be of the best quality of coarse, clean, sharp Allegheny river sand, free from dust, loam or other foreign matter, or a sand equal in quality thereto.

Water.—Water for mixing mortar shall be fresh and free from earth, dirt or sewage.

Broken Stone.—Broken stone for concrete shall be good, hard, clean stone that will not be affected by the weather, broken so that the largest dimension of any stone shall not exceed two and one-half (2½) inches, nor the smallest dimension of any stone be less than one-half an inch, and

must be free from dust, dirt or other foreign matter.

Proportions for Portland Cement Mortar.—Portland cement mortar shall, unless otherwise specified, be composed of one part in volume of Portland cement to three parts of sand, measured loose.

Proportions for Natural Cement Mortar.—Natural cement mortar shall, unless otherwise specified, be composed of one part in volume of natural cement to two parts of sand, measured loose.

Mixing Sand and Cement.—The sand and cement in the specified proportions shall be thoroughly mixed, dry, on a tight platform, with shovels or hoes until no streaks of cement are visible.

Adding Water.—Water shall then be added in sufficient quantity to produce a mortar of the desired consistency, and the whole thoroughly mixed with shovels or hoes until a homogeneous mass is produced.

OIL ON ROADS.*

By Henry I. Budd, Commissioner of Public Roads of New Jersey.

Southern California should have the credit of first making dustless roads by the use of crude oil. The idea first originated in Los Angeles county, where many miles of dusty roads were treated with satisfactory results, having been made absolutely dustless at all times.

The idea originated with F. W. Mattern, of Los Angeles, who, after experimenting ten years, obtained letters-patent. L. B. DeCamp became interested in the patent, and it is through his efforts that the usefulness of the oil process for dust-laying has been demonstrated in Los Angeles and San Bernardino counties, California.

The machine for distributing the oil on the roadway is quite a novelty. It consists of a portable tank, six feet long, running on two wheels, which are attached to the rear of an oil-tank wagon. The oil is discharged through tubes, six inches apart, underneath the tank, which are operated by a lever. Only a sufficient amount is let through to take up the dust. The oil is run in furrows made by a little hoe, and is covered by other hoes following. This is to prevent the oil from seeking a level in any low place and becoming unevenly distributed on the road. After all the oil has been applied, the same machine is used to incorporate the oil and earth. Two horses are attached to the apparatus, and by means of numerous other friction teeth, and by going over the road the balance of the day, for the purpose of incorporating the earth and oil, the road is made ready for use. The oil used is a heavy quality of asphaltum oil and is applied hot. The affinity (the earth for the oil), when both are hot, is very great. The amount of oil required varies between 50 and 60 barrels per mile for the first general treatment. Subsequent treatments require about 20 barrels per mile. A road having an ordinary amount of travel requires three applications to keep it in good order. The first application should be made as early in the spring as possible, at any rate as soon as the dust has become hot from the action of the sun.

To get the best results a good foundation is necessary, although the dust can be laid on roads having no foundation, but the expense is greater.

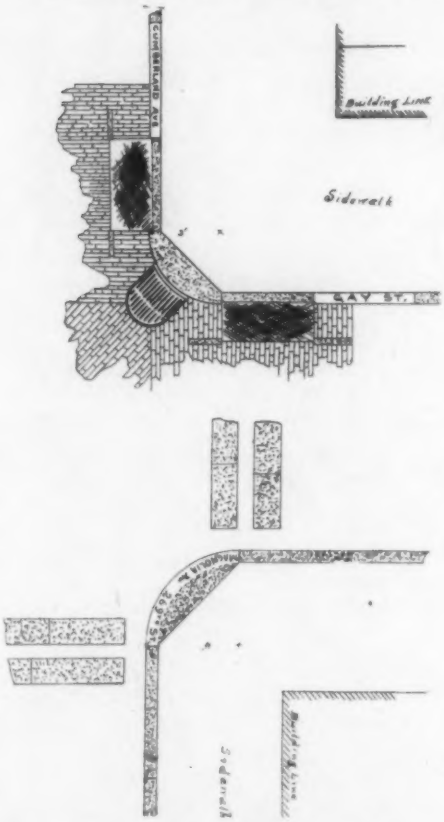
One of the principal streets of Long Branch was treated with the oil process, and reports concerning it are generally satisfactory, sections of the street with a good foundation showing perfect results and a dustless driveway.

*From Sixth Annual Report, as Commissioner of Public Roads of New Jersey.

A NEW PLAN FOR LOCATING STREET SIGNS.

To the Editor of Municipal Engineering:

SIR—I send you herewith a sketch of a proposed method of solving the much-discussed question of how to fix street signs in conspicuous and



permanent position. The idea is the result of a recent discussion of the subject in Knoxville, Tenn., and presents advantages of cheapness, permanency and conspicuousness. The letters should be cut into the curbstones in positions as shown in the sketch. Some corners will, of course, be found where there is no curbstone, in which case other methods must be resorted to, as lamp posts, sign posts, fence corners, etc., but in the business portions of all cities where street names are most needed there will almost invariably be curbstones on which to cut the names. The top of the stone bearing the letters should be cut quite smooth and where possible they should be of a different natural color. Names cut in curbs in this manner, with the letters painted black, are remarkably conspicuous, especially to pedestrians, and, being on the curbs, are more permanent than in any other position. I have never seen this idea

Scale 1 = 4'

in print nor practice, hence I thought it might be of interest to your magazine to publish it.

M. NICHOLSON,
Ass't Engr. to City Engr.
Birmingham, Ala.

THE QUESTION DEPARTMENT.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

EXPERIMENTS IN THE USE OF OIL FOR STREET SPRINKLING.

I am desirous of information regarding the success of the use of oil for street sprinkling. I may say, for your information, that our streets are mostly macadam, of which we have over ninety miles. I should be pleased to have your opinion as to how much oil would be required per lineal foot, for a road thirty feet wide, and for how long one sprinkling would be satisfactory. *C. H. Topp, City Engineer, Victoria, B. C.*

The latest information on the subject comes from the Massachusetts Highway Commission's experiments, and will be found on page 333 of the May number of MUNICIPAL ENGINEERING. The details of the experiment are not all given. In this particular case, 1,800 feet of road were treated, at a cost of $4.35 for 100 lineal feet, 15 feet wide. The effect was excellent at first, but in about a month the surface began to "unravel," and additional binding material was required. Complaints were made of injury to clothing and carriage trimmings, by the oily particles thrown by the wheels into the vehicles. This would indicate that the treatment of macadam roads or streets with oil is not entirely successful. The experiments with dirt and sand roads are more satisfactory, perhaps, because the improvement in condition of road in wet weather, as well as in dusty weather, is so much more marked, and because there is no artificial surface to "unravel," to use the expressive term of the Massachusetts report. Additional information by Mr. Henry I. Budd, Commissioner of Public Roads, New Jersey, is given elsewhere in this issue.

METHODS OF SEWER CONSTRUCTION.

(1) How long or how much does it shorten the life of sewer pipe when a hole is broken into it for making a connection used as a Y? (2) Is a large pipe more serviceable than a small one on a street closely built up for a distance of 500 feet? My thought is that it should be at least an 18-inch tile or larger. (3) In building catch-basins on streets where there is no pavement is it better to have the outlet on the bottom or have it about two feet above the bottom and have a wall between the main catch-basin and the outlet, say about six inches apart? *M. J. Dill, C. E., Kane, Pa.*

(1) This depends upon the quality of material and workmanship in the pipe and the care with which the work of making the connection is done. In general, the integrity of a pipe sewer is materially injured by connections made in this way. The best practice requires that the entire section of pipe be removed and a Y-branch of the desired dimensions be inserted. If the pipe has sockets it will be necessary to cut them out in part, and special care must be taken to make the joints tight.

(2) This depends upon the service required of it. For house sewage only an 8-inch pipe may be sufficient, but hotels and blocks using large amounts of water will require an increase of size. An 18-inch pipe would be too large to work satisfactorily under these conditions, not to speak of the unnecessary increase in cost. If storm water is admitted an 18-inch pipe may be too small. This might even be the case under some circumstances if roof water only were admitted. The first step is to determine the maximum amount of water the pipe must carry; the second to establish the grade. The size can then be determined definitely.

(3) A catch-basin is a waste of money if the outlet is at the bottom. A simple inlet to the sewer, usually trapped, is less expensive than the ordinary design of catch-basin. The primary reason for the catch-basin is to prevent deposits of street refuse in the sewer, the

basin being so arranged as to give such refuse an opportunity to settle where it can be reached and removed easily. A hanging wall or an iron cover to the outlet, of suitable form, serves as a trap to prevent sewer air from escaping through the basin.

HOW OFTEN FLUSH TANKS SHOULD BE DISCHARGED.

Our borough has put in a separate sewer system, and will have in the neighborhood of fifty-two flush tanks. About twenty-three of these will be double tanks, with a capacity of 720 gallons. The size of the pipes will be from 8 to 20 inches. In some places the grade is 2 to the 100 feet, and at other places 10 to the 100 feet. The consumption of water is equal at present to about 65 to 70 gallons per day for each inhabitant of the borough, besides the roof-water, which will go into the sewer. The question we wish to ask is, How many times is it necessary to have these tanks flushed? In the ordinance with the borough it says the company shall furnish sufficient water for a separate sewer system. The borough engineer insists that they must flush twice a day, while according to the information we can get from other places where the system is in use, once a day seems to be the rule.

D. M. Sloane,
Secretary Valley Consolidated Water Company, Bellevue, Pa.

The question of frequency of discharge of flush tanks is one which has not been definitely answered. Observations have not been made under all possible conditions. Some cities set the flush tanks to discharge as frequently as the supply pipe will fill them, without reference to the necessities of the case. This is a wanton waste of water. The water-works associations have called attention to this subject, and their discussions will be found in the proceedings of the societies. They are somewhat one-sided, but unquestionably there is a good opportunity here to reduce the consumption of water without injury to any one. It is usually assumed that one discharge a day of a flush tank is sufficient, and experience indicates that this assumption is correct. In a few special cases more may be necessary. It ought to be easy to settle any controversy on the subject by an agreement on the part of the water department to pay the cost of any special cleaning necessary on account of insufficient flushing, and to increase the rate of discharge of tanks in such special cases. The fact is that discharges less frequently than once a day are sufficient for the great majority of conditions, and many systems with favorable conditions exist with no automatic flush tanks, and requiring a very small amount of special attention. A disposition on both sides of a controversy to find out the facts in the special case, and fit the service to the actual conditions will result after a short trial period in the best and most economical service. See page 310 of the May number of MUNICIPAL ENGINEERING for some additional discussion on the subject.

HOW TO LAY CEMENT WALKS SO AS TO AVOID CRACKS.

Will you in your next issue ask through your columns the best mode of laying cement walk? I have in my experience found the best way to lay on the earth, clay soil preferable. All that I have come in contact with advocate gravel, broken stone, or cinders as a foundation. I also find that in any case they have cracked flags. My experience has been to lay on the natural earth. Are any of your many readers of my opinion? An expression from them would be welcome.

G. S. W., Rochester, N. Y.

We hope our readers will comply with the request of our correspondent.

The requisites in a cement walk are:

1. A well drained foundation.
2. A thoroughly compacted subgrade, and foundation.
3. Good material and good workmanship.

Cracks may occur, (1) because

frost enters a damp sub-grade or foundation, destroying its solidity and lifting the walk; (2) because a loose soil or lightly rammed foundation permits unequal settlement; (3) because poor cement is used in one or both layers of the walk, and the layers are not properly joined. Different cements are sometimes used in the concrete layer and the top layer with success, but slight differences in chemical composition, in rate of expansion frequently cause separation of the layers. If the concrete is allowed to take its full set before the top is put on the same trouble may occur. Our readers will probably suggest other sources of trouble, including errors in sizes of blocks and lack of proper opportunity for expansion. The cinder or gravel foundation is almost always specified as the surest method of securing the first two points mentioned. In another column we give the latest specification for cement walks received at this office, sent us by John Brunner, Superintendent of the Bureau of Engineering and Construction of Pittsburg. It should insure a good and durable walk if good cement is used.

CHECKING OF CEMENT WALK SURFACES.

Will you kindly inform us why the frost should affect some sidewalks and not others? We think the cause arises from the cement used, as some sidewalks stand the severe cold weather perfectly, while in others the finish is checked with the frost, but the rest is as hard as a rock. Kindly give us what information you can with reference to the above, and oblige,

Schillinger Bros., Detroit, Mich.

There are some mysteries as yet in the action of cement, or, at least, some points on which there is much diversity of opinion. Will our readers not give their experience and their explanation for the action observed? The checking described by our correspondent seems to be caused by unequal expansion of the skim of neat cement or rich mortar and the layer of mortar underneath. In the writer's observation this has occurred on account of too early exposure to the sun's heat rather than on account of the action of cold. The latter action seems possible, however, if different cements are used having different rates of expansion, or if the finishing of the surface of the walk is delayed until the cement in the mortar of the top layer has progressed too far. See, also, the reply to G. S. W. Will any one suggest another explanation?

INFORMATION ON THE PROBLEM OF TUNNELING.

Have you knowledge of a book or paper containing such work as would be required by an engineer having charge of, or assistant, on the New York Rapid Transit Tunnel system? If so, kindly let me know name and price.

S. L. W., San Francisco, Cal.

Drinker's "Tunneling" is the encyclopedia upon the problems peculiar to the New York rapid transit system. The publisher's price of the book is $25 net. The writer knows of one copy, slightly shelf-worn, but otherwise entirely new, for sale, at $22.50 net. The book needs to be brought down to date on electric drills, and to some extent on other power drills. This can best be done by means of the catalogues of manufacturers. Eissler's "The Modern High Explosives" ($4) will make a good addition on its special subject.

BRIDGES OF CEMENT AND STEEL.

Can you refer me to books or articles concerning bridges of cement and steel construction, their materials and method of construction, and the inspection of the same?

David Thomas, Plymouth, Pa.

As to the materials and their inspection, Baker's "Treatise on Ma-

sonry Construction" ($5), Johnson's "Materials of Construction" ($6), and Byrne's "Inspection of the Materials and Workmanship Employed in Construction" ($3), are good books. A large number of cement and steel arches on the Melan system have been constructed in the last five years. Descriptions will be found in engineering periodicals, and will doubtless be furnished by Edwin Thacher, of Paterson, N. J., who has been instrumental in introducing this method of construction in this country.

USE OF SANDSTONE IN MACADAMIZING.

I wish to macadamize a road, three miles of which is light sifting sand and two miles of clay. Soft sandstone can be had in immediate vicinity. Will it be safe to use four to six inches of broken sandstone bottom with four inches of limestone surface—the latter is much more costly—or what would you advise? I wish a good job for ordinary country travel at low cost.

R. W. Farley, Hull, P. Q.

If the sandstone described can be broken into fairly uniform blocks, not less than about four inches in smallest dimension and five or six inches in depth, a telford macadam roadway would probably be most satisfactory. Set the blocks carefully on a well-drained and well-compacted sub-grade made to the form of the completed roadway, or a little flatter in cross section if the limestone top layer is made thicker in the center. The latter is preferable if the wear is concentrated on the center in the usual way. The soft nature of the sandstone makes it absolutely necessary that the limestone wearing surface be kept in good repair and always of full thickness. This means constant attention to the condition of the roadway, especially on hillsides and in rainy weather when the limestone is likely to be washed off the roadway. Unless the limestone is unusually hard this means the employment of a man for a large part of his time in the repair of the road, of length given.

The use of the sandstone, broken to ordinary macadam size, as a bottom layer, will not be quite so satisfactory, but if proper attention is given to repair of the top layer the road will be and will continue to be a good one. Take good care of the drainage that water may not collect in the foundation or on the road in the clay soil, and that roadbed and surface be not washed away in either clay or sand.

CATCH-BASINS WITH AUTOMATIC FLAPS.

I shall be pleased to receive any information that you may have at hand relative to catch-basins for streets, as to who makes them, or where the same can be purchased. The style referred to is that which has the automatic flap or lid, so as to prevent the escape of foul gases and odors, and yet at the same time permit the water to enter as it flows thereto.

W. E. Fulk, C. E., Decatur, Ind.

The writer does not know of a successful trap formed by an automatic flap or lid. One has the inlet under an iron bridge for foot passengers, at the street-crossing, with a grating and a flap at the end, through which the water flows from the gutter. Every storm washes debris under this flap and deposits it, so that the flap can not close until the gutter has been thoroughly cleaned. As a consequence there is no trap to the inlet. Another has the flap on the outlet to the catch-basin, but here again floating matter prevents the closing of the gate and the trap is never air-tight. A trap with a water-seal would be less expensive and would require much less attention. Several such inlets and basins are shown in our advertising pages, all of which are much more satisfactory than the device suggested.

RULES OR TABLES FOR DETERMINING THE SIZES OF SEWERS.

I have read your answer to "Subscriber," page 368, June number, but am unable from your description to determine if any of them include the information I desire. What I wish is a work that gives reliable rules or tables from which the sizes of sewers for certain districts can be determined. *C. E. Martin,*
Piqua, Ohio.

The object of Ogden's "Sewer Design" ($2) is to develop the principles by which to determine the sizes of sewers for districts under various conditions of rain-fall, soil, population, improvement, water supply, gradient, quality of workmanship, method of flushing, etc. A thorough knowledge of this book and experience in applying its principles is required to insure success in designing a sewer system. About two-thirds of Folwell's "Sewerage" ($3) is devoted to the same subject, the other third describing methods of construction. Four of the fifteen chapters of Staley and Pierson's "Separate System of Sewerage" ($3) discuss this question on the basis of discharge of sewage only, with some attention to storm-water.

A DAY'S WORK IN HANDLING MATERIALS.

Please inform me if there is a book published to give me the estimate of a fair day's work in digging heart clay, rock, blasting, that is a day's work in all trades in building from foundation to roof, and price in all material, and strength in woods, iron, cast-iron, and weight, and oblige, yours truly, *Ign. Bilodeau,*
Quebec, Can.

No book gives all the information desired. Prices fluctuate too much to permit a permanent record in book form. The amount of work required to handle materials depends on local circumstances and character of labor, so that book estimates upon this point are only approximate. The following books will be of assistance: Kidder's "Architect's and Builder's Pocket Book" ($4); Kidder's "Building Construction and Superintendence, Vol. I, Mason's Work" ($4); Vol. II, "Carpenter's Work" ($4); Hodgson's "Builder's Guide and Estimator's Price Book" ($2); Haswell's "Engineer's and Mechanic's Pocket Book" ($4).

[By C. W. Tooke, Professor of Public Law, University of Illinois, for MUNICIPAL ENGINEERING.]

COURT DECISIONS ON ELECTROLYSIS.

I am interested in behalf of this village in the prosecution of an action against a railroad company for damages caused to its water-works system by electrolysis, and should like to know if you have any literature upon the subject which would probably aid me in such prosecution; I should also like to be cited to any reported court cases, of which you have knowledge, in which the law on the above subject has been decided.

Your kindness in citing any such cases, and in advising me as to any such literature, will very greatly oblige
P. H. Rue, Franklin, Ohio.

The whole question of damages from electricity is yet in its formative state, and little can be said definitely upon the subject. The latest and best book upon the subject is "Keasby on Electricity," published by the Boston Book Company. This work can be obtained from any dealer in law books, and will be found to contain all the decisions of our courts down to the present year. A letter to the West Publishing Company, of St. Paul, will bring information with regard to cases that have been adjudicated since that time.

THE ILLINOIS LAWS FOR THE CONSTRUCTION OF WATER-WORKS.

I desire to correct an apparent misapprehension on the part of Mr. Hainsworth in his criticism of my answer to Mr. Huston's question in the May number of MUNICIPAL EN-

GINEERING. It was no part of my purpose to pass upon the constitutionality of the law under discussion, but simply to reply to the question asked by Mr. Huston as to the reason why brokers discounted the certificates so heavily, and whether it would be advantageous for a city to purchase or extend water plants under the provisions of the law. Before writing the answer I took occasion to consult the attorney of a firm which handles more municipal securities, perhaps, than any other firm in the state. The point that I wished to make was that the mere fact that the law had never been passed upon by the court would require any conservative business man to take that risk into consideration in the purchase of the certificates. While it is true that similar laws have been held not to contravene the constitutional provisions in other states upon the limitation of municipal indebtedness, it is also true that the Illinois provision is much more stringent than those of the other states, and that it has been far more strictly construed. As an illustration of this fact I may be permitted to call attention to the case of the City of Chicago *v.* Galpin, a review of which appears in this issue, in which contracts for lighting that would be considered valid in New York and in other states were held to be void under the law of Illinois.

LEGAL DECISIONS AFFECTING MUNICIPAL AFFAIRS.

[By C. W. Tooke, A. M., LL. B., for MUNICIPAL ENGINEERING.]

LIMITATION OF MUNICIPAL INDEBTEDNESS—LAW OF ILLINOIS.

The strictness with which the supreme court of Illinois construes the constitutional provision limiting the amount of indebtedness which a municipal corporation may incur is shown strikingly in the case of The City of Chicago *v.* Galpin, reported in volume 183 of the Illinois Reports at page 399. The appeal from the superior court of Cook county was from a bill praying for an injunction on behalf of certain tax-payers of Chicago to restrain the city from awarding and executing certain contracts with the American Development Company for furnishing gasoline lamps in the outer districts of the city and to restrain the defendants from paying any money under the contracts, if already executed.

The two contracts set up in the bill were entered into September 22, 1897. One was for "2,800 lights (more or less) to be operated and lighted by the said party of the second part, * * * the price to be paid the party of the second part to be at the rate of $11.48 per annum for each and every lamp lighted, payments to be made monthly." The term of the contract was for one year, with the privilege of the city, upon notice, to continue the contract in force for another year. The second contract was for lighting 7,000 lamps upon similar terms as to payments and continuance as in the previous one.

The real question turned upon the point whether the contracts were void under the constitutional prohibition. The court holds that the liability was definite, and that the qualifying words "more or less" in such a contract, where the quantity of articles called for is material, is only for the purpose of guarding against avoiding the contract in the case of accidental or

trifling variation from the specified number. The court very properly says: "We also think that the contracts show upon their face that the parties contemplated the lighting of and payment for a definite number of lamps—2,800 or 7,000—simply recognizing by the use of the words 'more or less' the probable result that one or more of the lamps, for one or more nights during the month, might not be lighted, and the agreement on the part of the city, in effect, is to pay for the whole number of lights at the rate of $11.48 per annum, at the end of each month, simply taking credit upon that amount for lamps not lighted, if any, of which the required notice had been given." As the city had already reached the constitutional limit, the court accordingly declared the contracts void, and sustained the injunction granted upon the petition of the tax-payers.

SPECIAL ASSESSMENTS BY THE FRONT FOOT—RECOVERY OF MONEY PAID.

The supreme court of Massachusetts, at its May term, had occasion to pass again upon the question of the constitutionality of the statute of that state authorizing municipalities to construct sewers, and to pay for them by assessing the costs according to the front-foot. (Dexter *v.* City of Boston, 57 N. E. R. 379.) The court simply states, in accordance with its decisions in the Sears cases (173 Mass.), that it is now the settled law of the state, as of many other states, and of the United States, that, after the construction of a public improvement, a local assessment for the cost of it can not be laid upon the real estate in substantial excess of the benefits received by the property. Such assessments must be founded on the benefits and be proportional to the benefits. In deciding that the money paid under the assessment could be recovered back, the court says that, as the statute was unconstitutional, there had not been a mere irregularity in the proceedings, but that the assessment was to be considered as utterly void.

In this connection, we may be permitted to call attention to the fact that every court that has been called upon of late to pass upon this question has taken the view of the Norwood-Baker case that was set forth in the February number of MUNICIPAL ENGINEERING (page 93). It may be worth while to enumerate the decisions which sustain the view therein taken: Hutcheson *v.* Storrie (Tex. Sup.), 51 S. W. 848; Sears *v.* Board (Mass.), 53 N. E. 138; Same *v.* Commissioners, *Id.* 876; Walsh *v.* Barron (Ohio Sup.), 55 N. E. 164; Birdseye *v.* Clyde, *Id.* 169; Loeb *v.* Trustees, 91 Fed. 37; Fay *v.* Springfield, 94 Fed. 409; Lyon *v.* Tonawanda, 98 Fed. 361; Charles *v.* City of Marion, 100 Fed. 538.

REMOVAL OF TELEPHONE WIRES BY MUNICIPALITY—THE LAW OF GUERNSEY.

The Judicial Committee of the Privy Council, to which appeals may be carried from the colonial courts, passed down a decision on March 24, in a case that is of interest not only to English but to American readers as well. The law of the Island of Guernsey is based on the old customary law of Normandy, but the decision in this case is founded on principles applicable also in countries that are under the English common law. The appeal was carried up by the National Telephone Company whose wires had been re-

moved from the public thoroughfares of the parish of St. Peter Port by order of the constables of that place. The company was operating under a general franchise, but no special power had been given it to do business in the Island of Guernsey, and no grant of permission to use the streets had been made by the parish authorities. The appellants, deeming such permission unnecessary, proceeded to erect and carry their wires over certain streets and in such a way that they did not interfere with the user of the streets or endanger the safety of the public. The parish authorities, however, ordered them to be taken down, and upon the non-compliance of the appellants, caused the wires to be cut down and removed. The court in dismissing the appeal, refused to consider the question whether the parish authorities had the statutory authority to act in the case, but based their decision upon the ground that, as the telephone company had no right to erect its wires in the streets, the public officers had a right to remove them therefrom as incidental to their power of general control over the thoroughfares. (See in this connection, MUNICIPAL ENGINEERING, XVIII, page 37.)

COMMENT ON CURRENT TOPICS.

Standard Tests and Methods of Using Cement.

The questions numbered 21 to 31, asked by the committee of the American Society of Civil Engineers, upon the proper manipulation of tests of cement, are upon the preparation of pastes and mortars for tests of time of setting, soundness, and strength. This is the field in which the personal equation of the operator has most effect upon the results of tests and is also that in which conditions for the moment of mixing, of moisture of atmosphere and of materials before mixing, of cement as measured or weighed, of sand and of temperature, are of considerable importance. There are so many conditions variable with local circumstances and with the observer, that it is probably impossible to make rules which will fit them all, and which will insure satisfactory comparisons of results obtained by different observers, or even of results obtained by the same observer at different times and with different materials, unless he has had sufficient experience in the manipulation of many samples under various conditions to vary his methods and proportions to correspond. The best we can hope for is that the committee may develop the principles upon which the methods should be based and make such general suggestions as may serve as a guide and thus bring about an approximation to uniformity. The answers to the questions given in the preliminary report show the need of some expert suggestions of this sort.

The general opinion seems to be that the same method of preparation should be used for each test (question 21), but the answers in

the negative are from persons whose opinions have sufficient weight to leave the question open as yet. The German official rules provide for neat tests for time of setting and soundness, and for tests of sand and cement mortar for strength. The American practice seems to have been to test the cement neat for strength, but the addition of the test of mortar has become popular, and should be provided for in the standard rules. Experience indicates that the results of such tests are the more valuable, when properly made, but that they should not entirely displace the neat cement tests.

Eighty per cent. of the answers to question 22 say that the proportions of sand, cement and water should be stated by weight. This is unquestionably the safest way to get uniform mixtures, the volume of cement varying so much with the method of handling. It is not so essential with sand properly sifted; indeed, it would be better to measure moist sand than to weigh it. Water varies so slightly in weight per unit volume that it can be measured in the most convenient manner. The proportions will be measured by volume in actual work, but they should be fixed originally for the given materials by weight, and the corresponding proportions by volume can then be determined for the working conditions within reasonable limits of variation.

The answers to questions 23 and 26 are very diverse. One-half the answers agree in saying that as small an amount of water as possible should be used in preparation of the paste and most of the opinions of the other half are quoted in the report showing that all the variations in results of tests are not due to personal equation. The answers do not distinguish sufficiently between pastes of neat cement and of cement and sand mortar, nor do they pay attention to the condition as to moisture of the air and the materials and instruments in use. Apparently slight differences in moistness of sand make considerable differences in the amount of water required. If the laboratory is always dry and warm the sand will become so and remain so, while if the laboratory is in a damp cellar or even in a basement dry but cool, in weather with air full of moisture, the sand will absorb more or less moisture at times and the variation in condition of sand will require a variation in the amount of water. It is well known that different brands of cement require materially different proportions of water to make mixtures of the same consistency. Exact proportions of water for all conditions and cements can not be fixed, therefore, but it is possible to classify the kinds (not brands) of cement and give the average amount of water required for each class, leaving the determination of the slight variations from these stated amounts to be determined by the operator for his special conditions and material. Some standard of consistency should be rec-

ommended by the committee, if only one which can be approximately described and not measured in any manner.

As to questions 24 and 25, the replies indicate that the precise temperature of materials and of air is not important, the preference, when stated, being for temperatures between 60 and 80 degrees Fahrenheit. The hygrometric condition of the air is more important than its actual temperature, as stated above, and where correct laboratory conditions can not be attained, observations of wet and dry bulb thermometers, or other measures of the amount and condition of the moisture in the air, will give valuable information when particular care in manipulation is required.

Questions 27 to 31 ask what should be the method of mixing, hand or machine, with detail of manipulation, machine preferred, character of results, length of time of mixing either in minutes or by reference to character of resulting mortar. Nearly all answers state that the cement and sand should be thoroughly mixed dry and the water added afterward. Some would add the water all at once and others would add it little by little. Trowels, spatules, spoons and hands are used for mixing. Several mention machines in use or proposed which should give results, but no one says that he has found a satisfactory machine for mixing. Several are quite emphatic in saying that no machine is comparable for uniformity of results with intelligent hand work by experienced operators. The time required for mixing is as much a matter of judgment as the exact amount of water required to make the stiffest possible paste and must be learned by varied experience. Mr. Richardson estimates the time at about five minutes for slow-setting cements and less for quick-setting brands.

In all these points the question is not so much what is the best method as what method shall be followed in order to secure uniformity. In each case there is doubtless a best method, and if the experts, or any large number of them, can be brought to agreement as to what is the best method, that one should be selected.

But, for example, the strongest briquette is made by using the smallest possible amount of water. This amount can not be exactly determined in advance for all cements and sands under all conditions, and must be left to the individual operator. A lower tensile strength will be found if more water is used, but in such case the exact proportion of water can be fixed by rule, and slight differences in consistency of mortar on account of peculiarities of the materials used will make only slight differences in strength. The committee will choose the method it thinks best, but whether it is the best or not is not very material so long as one is chosen as the basis for uniformity. The same is true of some other items.

How Politics Detrimentally Affects Efficiency in Municipal Management.

We are in receipt of a letter from a man who has shown himself to be a capable and efficient superintendent of water-works in a western town, in which he says:

> I am desirous of making a change, and would like to get a position with a company as superintendent. I have had charge of this plant and water system for six years. I can furnish letters of recommendation from the various city officials that have held office during my time. My reason for making a change is that politics is working into this place. This being the condition, I do not see any sure thing ahead unless I get into politics myself, which I do not believe belongs to this kind of a position.

This letter would be an excellent text for a sermon were it not at the same time both text and sermon. Some questions not usually considered it may be well to discuss. Politics, favoritism and nepotism are evils of municipal ownership; nepotism, favoritism and politics are evils of private ownership. Excellent results are obtained in many cases where favoritism and nepotism are rife because the basis for favoritism may be largely merit, and in works under private ownership relatives of the owners are required to make preparation for their duties before they are given responsible positions. There are no compensations for the baneful effects of politics and nepotism under municipal ownership; and the only compensation for political appointments under private ownership is the excess of value of the privileges granted, the taxes rebated or the rates fixed, over the salary paid for nominal services and the money wasted by errors of ignorance or lack of judgment in such employes.

The tenure of office of a good man is likely to be more secure under a private company than under municipal ownership. There has been some attempt to show that the average term of employment of responsible heads of departments and expert employes is not longer in private than in municipal employment but the case has by no means been proved, and one class of employes seems to have been omitted from the consideration. This class is made up of the men who are part owners of the property, either from choice of this method of investing their little capital, or from the policy of the owners in giving their most responsible employes a special interest in their work, by making them part owners to some extent. This class must be considered in making a comparison of the relative advantages of employment under municipal and under private ownership.

In large corporations, where the strictly financial management can be separated from the supervision of technical details, the superintendent can be a man of technical ability and training without reference to his qualifications for political manipulation, such duties devolving upon other officials, but in smaller systems, where practically all the management and operation of the works devolve upon a single man, with little assistance from other officers or owners, the superintendent must be a man capable not only of operating the works

economically, but of dealing successfully with the political questions which arise in the course of transactions with the municipal officials. So far as this official is concerned, therefore, he must be quite as good a politician as his brother superintendent in municipal employ. One manipulates men for the financial benefit of his company, the other to retain his position. The ends to be attained are different, the means of attaining them are much the same. The advantage on the whole is rather with the employe of the private company, the periods of unrest and of possible change being fewer and less subject to the influence of personal prejudice and unreasoning ignorance.

Improvement in the official tenure of responsible employes will come in the one case when publicity of the accounts of private corporations operating public utilities, and better control of some details of their financial systems by the municipality, removes such corporations from the field of the promoter and the stock manipulator who revises, reorganizes or wrecks companies for the benefit of their own pockets. In the other case it will come when some sort of civil service and its attendant certainty of employment during good behavior and efficient service takes the technical positions, at least, out of the reach of the politicians. The objections to these propositions conceal their advantages from those who expect a perfect plan before any change is made—but it is not the intention to consider these lines at this time.

A Pointer for the Unsuspecting.

Referring to an article in the June number of MUNICIPAL ENGINEERING, a New York subscriber sends us a letter from the *Southern Trade Record* of Cincinnati, enclosing a proposed editorial endorsement of the goods he manufactures, indicating that the system is applied to all sorts of manufactures and supplies as well as to engineers. The date of this letter is March 16, and the name of the editor is changed. This time the surname is the same as that of the publisher of the *Southern Review of Commerce* of Louisville, and a comparison of the latest letter with the one from the latter paper, mentioned last month, shows still closer agreement in word and phrase than that then commented upon. The letters are identical with the exception of about a dozen lines. The accompanying "editorial endorsement" strengthens the belief that the monotony of contents of the journals mentioned should seriously affect the subscription list and gives additional ground for suspecting a close connection between the managers of the two papers. Our correspondent thinks "it is well to call attention publicly to such schemes if by so doing some of the unsuspecting may heed a timely warning."

Serious Results from Defects in Water Pipe Systems.

The destruction of about five blocks of the business property of Bloomington, Ill., by fire on June 20, carries a lesson for many of our smaller cities. Press reports state that the supply of water to the city is through a 20-inch pipe for a distance of about a half mile from the pumps, and that the largest pipe from the end of this large main to the center of the burned district, about another half-mile, is 10 inches in diameter. The same reports state that when six streams were thrown the water did not reach the third floor of buildings. It is denied that there was any scarcity of water or trouble with the pumps, and the standpipe is said to have overflowed. The lack of water was due, therefore, to the fact that the frictional resistance in the 10-inch pipes was so great that the head available at the standpipe and pumps was not sufficient to force the desired amount through, and this head was so nearly used up in overcoming the friction that but little was left to raise the water to the blazing upper stories of buildings. Six good streams, at the time the fire was first discovered, would probably have confined it to the first building or two. The science of hydraulics is sufficiently exact to make it possible to predict the effect of a given set of conditions, so that there is no valid excuse for setting up as a defense to the state of affairs here existing the plea that defects can only be determined when severe tests develop them. A hydraulic engineer who knows his business could demonstrate these facts and make predictions of the results of given possible conditions after a short study of the existing constructions which would be fulfilled by future events. The city of Bloomington had an experience with a break in the single supply main 20 inches in diameter last year, which called attention to some defects in the design of the pipe system. A second 20-inch main was suggested at that time, but because a connection with a 10-inch main could be made for a few hundred dollars, while the 20-inch main would have cost a few thousands, the cheaper construction was made, though the second supply main thus secured is entirely useless for fire purposes, and would be inadequate for domestic supply and only valuable as a makeshift while repairs on the broken 20-inch main were in progress.

The fact is that the needs of the city for fire protection have outgrown the system, and the city council has not been willing to follow the suggestions of interested property-owners, and expend the few dollars necessary for an expert examination of the system, with a view to bringing it up to the requirements of the present and the immediate future. It is quite probable, also, that sufficient attention was not paid to the requirements of fire service in the original design. This is a frequent defect of small

systems. It is rapidly exaggerated as the town grows into a city. A few hundred dollars expended last year in an investigation by an expert, and a few thousand in carrying out his recommendations, would have saved the millions that went up in smoke during the seven hours' conflagration.

Bloomington is not the only city in this condition. Their name is legion. If they will all draw the obvious lessons from her calamity, they will be saved a like disaster. The same calamity has befallen so many for the same reason, however, that this one, somewhat larger than usual, will probably not arouse a baker's dozen of city councils to real action. Tax-payers' pocketbooks are close at hand, and look large, and their votes count, while disastrous conflagrations are in the dim future, and may never occur, and few votes are influenced by the fear of them.

Steam fire engines are but a temporary expedient, and an expensive one, and are usually inadequate if the defect in the system is small pipes. They are valuable, and often indispensable, as well as economical, if specially high districts or buildings in small numbers must be reached. For this work they should be of the best construction and of large capacity.

UTILIZATION OF EXHAUST STEAM FOR HEATING.*

By H. J. Frith, Superintendent Electric Light and Heating Company, Watseka, Ill.

The net earning of an electric light or power plant is controlled by the gross income less the operating expenses and fixed charges. In all cases it is desirable that the greatest return or net earning be produced on the money invested in the enterprise. To accomplish this result each expense item must be reduced to a minimum and all productive factors, men, machinery and equipment, worked to the fullest capacity.

Unfortunately the electric load runs up to a peak of short duration and machinery of ample capacity must be provided to carry the peak load, requiring investment often times out of proportion to the average load. Boilers, in particular, prove inefficient on account of the short duration of their operating period. Could the boiler load be continuous the efficiency would be greatly increased, and any plan which will provide a more uniform boiler load is a step in the right direction.

While the hours of the station employes are usually a little long, the actual labor performed is light, and if a uniform load were available (say nearly equal to the peak) it could be cared for without additional labor expense. This is impossible; then so near as practicable each man and piece of apparatus should fulfill those conditions which (provided the returns are sufficient)) increase the net earning, accomplishing a much desired result.

To ways and means for this end I shall take up the production of current and resulting by-products. The primary operation is the production of steam by burning coal in the furnace, which gives steam and waste in the form of flue gases, radiation of heat from the furnace, etc. Ashes are left as a by-product of more or less value, as in most places a ready market for them exists. Aside from this insignificant saving, there is in the steam generator no particular by-product which can be utilized in large plants where the flue gases may be put through fuel economizers and part of the heat in them saved.

The efficiency of a tubular boiler under test conditions is probably very near 75 per cent. However, under ordinary condi

*Read before the National Electric Light association, Chicago, May 22-24.

tions as found in the smaller class of plants, 60 per cent. to 70 per cent. probably more nearly represents the results obtained Clearly there is little or no chance of bettering this part of our station unless means are found whereby the boilers may be kept under a more even load.

The next operation is the use of the steam generated in the boilers by the engines whereby 8 per cent. or 10 per cent. is utilized—that is, 10 per cent. of the available heat is converted into work. This, I believe, is a maximum figure for plants using simple engines, run non-condensing. The engines deliver some 10 per cent. of the heat of the steam in the form of power and waste the 90 per cent. balance in form of exhaust. Of this exhaust which may be considered a by-product, something can be saved in heating feed water, so it is safe to say that fully 80 per cent. of the heat delivered by the boiler is—while a valuable by-product—thrown away and wasted, and represents a large portion of the operating expense. Not only is the heat thrown away but nearly all of the water evaporated is also thrown away. If this water be saved it would not have to be replaced with fresh water and much trouble with dirty boilers would be avoided.

The other losses in transmission and conversion into electrical energy are well known and are small. The heat in the exhaust represents the largest loss of a by-product and I shall consider means for saving it and converting it into a profit. Can this be saved and made to yield a profit? I believe it can by using this exhaust steam for heating purposes. However, we should have an ideal system. The saving and sale of this heat and the saving of the water of condensation requires careful consideration.

The temperature of exhaust steam—without back pressure—is 212 degrees Fahr., making it only applicable for heating buildings. To use this for heating purposes from an exhaust heating central station, it is necessary to have a proper distribution of the heat to the points of consumption. And in distributing heat from a central station to distant points one is confronted by a problem of no mean proportions.

First—the heat must be conducted through pipes, which must be well insulated to prevent radiation and loss.

Second—The heat must be moved rapidly.

Third—The heat in the exhaust steam must be used without placing any back pressure against the engine, for back pressure is a serious detriment to the efficiency of a steam plant. The ordinary engine working under economical conditions with a steam pressure at the throttle of 85 lbs. shows a M. E. P. of 35 to 40 lbs., if there be no back pressure except that required to overcome friction of the exhaust steam in its passage through the exhaust ports to the atmosphere.

Back pressure detracts from the load-carrying capacity of the engine. Even five pounds back pressure means one-seventh of the power of the engine thrown away. To be sure this may be offset by increasing the boiler pressure by some ten pounds, but this is not an economical operation, and in many cases it is impossible.

Fourth—The system for furnishing this heat must be able to supply any class of consumers.

The degree of heat must be under perfect control and be adjustable for the various outside temperatures and weather conditions or else unsatisfactory heat as well as inefficient operation will result.

A system in which the radiators are always at or above a certain fixed temperature, regardless of the demand, is similar to burning lamps all day to have light for the night. It is very evident that in an ideal system the regulation of the degree of the heat circulated must be under absolute control so that a suitable heat may be furnished on a mild spring or fall day as well as during a midwinter blizzard, and all intermediate weathers.

In a steam system the radiating surface is always at least 212 degrees. A necessary feature in successful heating is lost for either or all of the heat or else none is available; and on mild days, with the heat all on, the windows must be opened to reduce the temperature, and with the heat all off it is too chilly for comfort.

The heating period has very few blizzard days, annually perhaps a dozen, about thirty days of zero weather and the balance is weather when the temperature ranges from 70 degrees down to zero. This puts the system at maximum capacity for about a dozen days, medium capacity for about thirty days and under a light load for the greater portion of the time, which latter condition prevails for fully three-fourths of the season. Clearly, regulation and ability to furnish mild heat are very important features and in an ideal system the degree of heat must be under absolute control. In

other words, there must be distributed just enough heat at just the right time and place; and a system in which the degree of heat cannot be varied at will, must of necessity be wasteful during the period of light load.

Fifth—It is necessary to convey this heat from the central station to the various points of consumption in an efficient manner. For the accomplishment of this, it is essential that there be minimum losses of heat by radiation in the mains underground, which requires a rapid movement of the heating medium—also this operation must be accomplished with a minimum expenditure of power. The circulating device must be reliable and inexpensive to maintain; otherwise there will be a loss of power and consequently of efficiency.

The entire system must be reasonable in first cost, in maintenance and operating expense, must be simple and reliable. There must be no weak points in it. It must be compact and must occupy little space; must be neat in appearance and durable. All complicated parts and automatic devices must be avoided, as these are notoriously liable to get out of repair and give more or less trouble, requiring expert attention.

The system must be so constructed and installed that the depreciation account will be kept down to a minimum.

There must be provision to heat the boiler feed water, or, better still, the exhaust steam should be condensed (and filtered to remove any oil) and returned to the boiler at a high temperature.

What is an ideal system? Perhaps the best way to determine this will be to take up the various ways and means of central station heating and consider the advantages and disadvantages of the features which will help in the selection of an ideal system.

The exhaust steam from engines may be used as in the ordinary exhaust steam heating system. In this case it is delivered direct into the mains and driven to the points of consumption at a greater or less expenditure of power. To drive this steam and to increase its temperature in cold weather it is necessary to carry a back pressure against the engines furnishing the exhaust. Some time since, while investigating the heating question, I found that one station carried a maximum back pressure of 17 lbs., another 18, another 20—about half of the ordinary M. E. P. of a simple engine working at maximum efficiency. In another case I found the maximum back pressure was 38 lbs., which equals the usual M. E. P. In this latter case all the engines were high speed simple engines, and such a back pressure seriously affected the power delivered by the engines, requiring, too, an abnormal consumption of fuel. In fact, I believe it would have actually required less fuel to produce the results if the exhaust had been turned outdoors and the heating mains connected direct to separate boilers. I observed at another time a back pressure of 4 lbs. with the outside temperature at 63 degrees. At the same time a hot water plant was producing more satisfactory results to its patrons with water leaving the station at 130 degrees Fahrenheit and returning at 115 degrees Fahrenheit, requiring an expenditure of less power to circulate the water than would be represented by less than one-half pound back pressure; and there was actually no back pressure other than what occurs in all engines due to resistance of ports and exhaust pipes. Clearly back pressure, even in a small amount, must be avoided as it is more expensive than equal boiler pressure, for if the point of admission remains fixed we must raise the boiler pressure nearly a couple of pounds per pound of back pressure. We have also to consider that engines usually do not work as well when laboring against a back pressure. The increased steam consumption calls for the evaporation of more water and consequently more labor to keep the boilers clean and furnaces in repair.

Again with the use of exhaust steam direct into mains and radiators there is at least 212 degrees Fahrenheit or none. The increase obtainable at the expense of a back pressure is limited (not considering any objections to back pressure) to 250 degrees Fahrenheit, the temperature of steam at 15 lbs. pressure. This is a small range when compared to water which may be varied from 70 degrees to 200 degrees or more.

With a system of exhaust steam direct into the mains, all of the condensation is lost together with the heat in the condensed steam—something like 140 degrees of which is available, and is thrown away into sewers. Also all condensation of any live steam which may be used in time of an insufficiency of exhaust is thrown away, and this is a most important loss. If a sewer system is not available, into which to discharge the condensation, then one must be provided. And the hot condensation discharged into sewers often causes disagree-

able odors to back up into plumbing. At all air vents, cylinder oil causes unpleasant odors to give the system a bad name.

Then, too, a system of piping which will hold air or water will leak cylinder oil and cause more or less trouble from this source.

Since the range of temperature in steam heating mains is from 40 degrees to 250 degrees, greater care must be taken to provide for expansion and contraction than in a system where the range of temperature is through narrower limits. And because the temperature of steam systems runs higher than water systems it follows that better and more expensive covering must be used.

There is no perfect covering—hence condensation must take place in the mains. This requires that steam mains be carefully graded to avoid pockets, and where pockets are essential, means must be provided for removing condensation. Water mains, on the contrary, can be run regardless of grade.

Strange as it may seem, I have been creditably informed that in case of shutdown or a deficiency of heat in extreme cold weather that a steam system is more apt to freeze than hot water.

The drift of my talk, then, is toward the ideal system—and it is hot water. As a medium for transmitting heat, water has no equal. It meets all the required conditions and is acknowledged by engineers, architects and the medical profession to be the ideal heating system for residences, stores and public buildings.

With a hot water system as our ideal, then how can it best be applied to our needs? It is evident that the water must be heated in a tubular heater, similar to a closed feed water heater or surface condenser. It is important that sufficient opening be provided through the tubes so that all the exhaust steam can pass through the heater and to the atmosphere without producing any back pressure on the engines. In other words, there must be an open and free exhaust pipe at all times.

Sufficient surface must be provided to condense all the exhaust steam delivered by the engine and to allow none to escape. The water is circulated through the space around the tubes, where it absorbs the latent heat in the steam, condensing it. The circulation should be rapid so as to make the surface efficient. The condensed exhaust steam may be collected in a suitable settling chamber, or filtered to remove the grease, and then the clean hot water, now freed from all injurious foreign matter, may be returned to the boiler. All the condensed exhaust steam then is saved, and not only the pure water is obtained, but all the heat in it is saved as well, and that means probably 8 per cent. of the heat in the exhaust steam, making just so much more available for sale.

In addition to using the heat in the exhaust steam the system must have heat at times when no exhaust or an insufficiency of exhaust is available. Heat must then he supplied from another souce, and this may be done in several ways. A live steam connection may be made to the exhaust pipe and live steam blown into and mixed with the exhaust, and in some instances this is done, but this method has objections which seem to make it impracticable. In order to prevent too much live steam from being blown through the heater and to waste the live steam must be supplied through a reducing valve, and a back pressure valve is installed in the exhaust pipe to afford a pressure against which the re ducing valve can work, thus causing the engine to operate under a back pressure. Then, too, the live steam so used becomes mixed with the greasy exhaust, and not only must be pumped back to the boiler before it can be used over again, but must be purified as well. All this calls for extra in use in some places is to circulate the water through an ordinary boiler, and thus care and attention.

Another method of supplying extra heat heat the water in a hot water boiler direct from the fire This means that at least two boilers, or two sets of boilers, must be kept going—one set must keep steam to drive the pump used for circulating the water, and the other set to heat water. So an unnecessary number of fires must be kept going. The regular boilers and furnaces must cool down somewhat and the extra boiler and furnaces heated up in which, instead of the boiler being at some 325 or 340 degrees, the boiler is at a temperature of 200 degrees or less. This means that the furnace gases are apt to be chilled and an imperfect combustion result. From this comes smoke and soot, and, in general, a loss of efficiency, and this, in addition to the loss of efficieny due to the cooling and idleness of the regular boilers. It is a well-known fact that the best results are obtained from fuel under a boiler which is in constant use. Therefore the regular boilers should be kept hot as much as possible, and separate hot water boilers should not be necessary whenever the plant is a little

short of exhaust steam. Then, too, extra boilers require just so much extra space in the station and a heavy added first cost.

The way then to add heat to the system aside from that furnished by the exhaust steam is to use steam drawn from the regular boiler plant and used in a separate heater, similar to, but of course not so large as the exhaust boiler. This heater should be set above the boilers so the water of condensation will return to the boilers by gravity and at as high a temperature and with as little loss of radiation as possible. A separate heater permits the use of the full amount of heat in the steam without the possibility of wasting any steam. This condensation is kept absolutely free from oil or other impurities and is returned to the boiler, saving the need of filtering it and all power required to feed it into the boiler. This, I believe, is the most efficient means of supplying such extra heat as required. By this means in extreme blizzard weather the full benefit of the exhaust may be obtained with no back pressure, and then the water can be raised to a point above that of the exhaust if necessary in a far cheaper manner than by carrying back pressure to get such results. Also, the boilers are regularly under heat; the furnace always hot, etc., so the ideal system will have such a separate heater (for heating the water in time of insufficiency or absence of exhaust steam) set in series with the exhaust heater, with by-passes around each of them so that either may be out of service if so desired.

With means provided for heating the water, we can now consider means of circulating it from the central station to the customers.

In some instances duplex or single acting reciprocating plunger pumps have been used. As is well known, a steam pump uses steam non-expansively and consequently is perhaps the least efficient steam motor in the market today. In some instances as much as 125 lbs. of steam per H. P. hour are required. In addition to inefficiency pistons must be packed and cared for, valves must be looked after and renewed. Each stroke gives a pulsation to the entire system, the noise from which may prove annoying to the patrons.

This type of pump requires also considerable floor space and is expensive in first cost. The pumps for use with a hot water heating system must be more simple, more durable and by far more efficient. The centrifugal or blower type of pump best meets the requirements. For moving large volumes of water against moderate heads no type of pump is so efficient as this. And this pump (in addition to being much more efficient from the hydraulic standpoint) may be driven from the most economical source of power available.

If a line shaft run continuously then the pump could be belted from that and the horse power required be produced from 26 or 30 lbs. of steam per horse power hour. If current be available one pump might be driven by a direct connected motor and the duplicate unit might be driven by a small direct connected high speed engine, thus, in any event, using the minimum power for the maximum result.

These centrifugal pumps give no pulsation whatever. They turn out a steady, even, continuous stream. There are no valves at all to trouble and there is nothing about them to get out of order. In fact, there is merely a rotating disc in a chamber. There is nothing about them to break or wear out. This completes, then, the station equipment required—exhaust heater, live steam heater and pump for circulation.

We may now consider the system for distribution or piping of the territory to be covered by the system. It is quite true that to a considerable extent the laws that govern electrical circulation hold for water circulation and the electrical terms employed may with advantage be used to describe the water circuit.

The houses may be put in multiple, this requiring, of course, two mains wherever customers are obtained. One pipe would be the out-bound and the other for the return water. While at first glance this would seem to answer, yet it is evident that the farther out from the station the customer happens to be the less pressure there is between the two mains, and therefore less tendency to circulate. In other words, the houses near the station short circuit the houses far away, and in order to overcome this tendency to short circuit the taps or service cocks must be made larger toward the ends of the line. Thermostats, too, have to be called into play in each house in order to assist in equalizing a badly designed circuit by cutting in resistance in short circuits. To overcome the tendency of the last house on the line to cease circuiting, the station pumps must be operated under enormous pressures, even sixty to seventy-five pounds being used in some instances. Such heavy pressures require enormous pumps.

The two-pipe system in certain cases and properly laid out is an excellent device. The objection to it is that two pipes of a given size double the radiating surface that one would. There are twice the fittings and joints to trouble and twice the provision for expansion must be made. A single-pipe circuit then offers a solution to these difficulties. One pipe run in a circuit will answer the purpose of two. The house may be shunted off from the pipe, taking advantage wherever possible of whatever tendency there may be to circulate due to gravity.

In this system there will be required one medium-sized main for each circuit. It can be put in for a minimum expense as to cost of pipe, insulating and labor for laying. This main would be free of obstructions and of low "resistance," consequently it would require a minimum power to produce a rapid circulation, which will insure that the load can be carried with small drop. If the main is proportioned properly to the load, with a certain speed of circulation, there can be obtained any predetermined drop in temperature, which should be only 20 degrees Fahr. or such a matter. The service pipes need be only of medium size and but slightly more expensive to install than smaller ones, and cheaper to operate because of less resistance and some aid from gravity, thus reducing the circulating power and producing an economy. With this system of piping then, twice the territory can be covered with a given length of pipe by using a shunt system than can be covered with a multiple system, and at a much less expense—and will be far more economical as to the loss of heat by radiation as compared with the two.

The system may be an "open" or a "closed" one. By an open system I mean a system wherein the circuit at the station is open into a tank, and there is at that point no pressure. The water must be pumped from the heaters into the out-bound mains and raised to the highest radiator, whence, flowing back through the return mains, it runs into the tank. It is evident that the two-pipe plan must be used when the circuit has an open tank at the station. In other words the pump not only has to circulate the water but has to overcome the static head of the system.

If the system was closed, that is, had no open spot in it and the returns were brought directly back to the suction of the pump—then the static head on both suction and discharge would be equal and the only work the pump would have to do would be to overcome friction in the circuit and would not have to lift any water at all. This cuts the pumping head down to less than twenty pounds, where in open circuits it is often as much as 75 pounds. It might be assumed that this power would not be a loss at all as the exhaust from the power-producing source would be used for heating purposes, but this power is called for twenty-four hours per day and probably the steam producing agents in our plants now have enough during the "peak" of the electric load without added burden and during a large portion of the time the exhaust from the electrical load is sufficient, so for a couple of hours during the peak it would distress us to produce this excessive power and during a large portion of the twenty-four hours we should have to throw it away as our electric load gives a sufficient amount. So any extra pumping power required is a great detriment instead of being of no objection or even value.

In the electric station it is of great advantage to use storage batteries, charging them during the period of light load and using them to assist when the heavy load comes.

Is there an analogous case in heating? At the time of the peak the maximum exhaust is produced. Can this advantageously be saved and stored for use during the time of insufficiency of exhaust? It is evident that the load of a heating plant is limited only by the size of the electric station, as the lights required in a building will furnish only some twenty or twenty-five per cent. of the exhaust required for heating it. Therefore, the proper size for the heating system is such that in usual winter weather it will require all the exhaust except a little during the peak.

Consider the two sides of the storage tank. First, assume a 10 per cent. loss of heat in circulation; to do this it is necessary to have the medium move at a rate of 400 to 500 sec. per minute. What size tank would be required to hold sufficient water with its stored heat to supply from 3 to 5, 4 to 5 or 6 mains running at this speed? Necessarily of immense size, expensive, occupying much room, it would itself present a very large radiating surface, requiring extensive insulation and then lose much heat. Second, there would be only a little surplus exhaust during the peak to supply for heating the storage. In usual weather this would hardly be sufficient to care for the radiation of the tank alone. Under any circumstances there would not be enough to justify the installation of a

storage tank. Third, in blizzard weather there would be no surplus for storage. Fourth, in mild weather there would be no need of a storage tank, for there is sufficient exhaust at all times. Even in the case of a plant without day load I doubt the advisability of using a storage tank, because the stored water can be used but once, as its storage capacity is limited to the drop on the line some 20 degrees Fahr., because of the immense size to make it of any actual value and because of its cost, etc. It cannot prove a paying investment.

In extreme cold weather put on an extra fireman or use a little better grade of coal and use the live steam heater to make up for the extra cold.

To get the best results the equipment must be worked at its rated capacity in ordinary weather and to its extreme capacity in the coldest weather, otherwise the best efficiency is not obtained.

This about covers the principal requirements for an ideal system, a summary being as follows: A hot water system, using closed heaters to absorb the exhaust heat with sufficient openings to allow all of the exhaust to pass through without producing any back pressure, or capacity to condense it all; similar smaller heater to help out the exhaust, set above the boilers that the condensation may be returned to the boilers by gravity; save all condensation; centrifugal pumps suitably driven with a closed one-pipe system of distribution well insulated; a load requiring about all the exhaust in medium winter weather, which gives a system wherein the maintenance, operation and investment are minimum and the efficiency, reliability, simplicity and satisfaction to all are maximum, making the ideal system.

PUBLIC CONTROL OF RATES.*

By Geo. McLean.

The right of the state to regulate and control the rates of public service corporations is a principle of the common law. It grows out of the policy of that law respecting monopolies. It is sanctioned by the constitution of the United States, and by the constitution of the several states.

This paper is dedicated to the proposition that it is unjust and inexpedient on the part of public service corporations to oppose the principle of public control. It is addressed particularly to the fears of investors in gas securities that the vested interests of these corporations, of legitimate stock values, can be destroyed through the exercise of such power. It is intended to deny that public control of rates deprives the corporation of a motive for pursuing a liberal policy and making liberal outlays to secure new business. It is proposed to show that the whole subject is properly treated from the standpoint of the public interest; and that legislation in this interest will offer no menace to the legitimate interests of public service corporations.

The whole policy of the law supports the view that the state, or the municipality, which charters a public service corporation, should reserve the right to regulate its rates. Whether a city may regulate rates, when the power to do so is not expressed in the charter, is a legal question. So, also, is the question whether it may alter rates expressed in the charter. We are considering new statutes, ordinances and charters providing for public control of rates; and urging that this principle may be recognized, not only without jeopardizing the interests of public service corporations, but with positive advantage.

This right to regulate rates should be exercised when competition is present. Competition for lighting between gas and electricity is an unerring regulator of rates for both, and public authorities should not meddle with rates fixed by it. Whether their powers should be exercised against a combination depends upon the policy of that combination.

It will be objected that this power may be used to eliminate or, at least, to menace the legitimate profits of the corporations. The answer is that it cannot be used in this manner. The supreme court of the United States has repeatedly held that rates prescribed by public authority must be such as will afford a fair profit on the value of the property as a going concern. This means not alone what it would cost to reproduce the physical property. It means that the value of the business acquired must also be considered. Thus the public

*Read before the Western Gas Association, Chicago.

service corporation which gains a large business by putting solicitors in the field and pursuing a liberal policy, acquires an asset of which it cannot be deprived without just compensation. The decisions of the highest court have made the investor absolutely secure as far as this public authority to regulate rates is concerned.

The menace to investments, where it exists, arises from an illiberal or inefficient or incompetent management, or from interference in local politics, or dogged defiance of public sentiment, out of which arises public hostility, with its attendant dangers, loss of business, malicious prosecutions and a new and popular competitor.

The United States supreme court has affirmed the right of the municipality to condemn at any time the property of the public service corporation to which it has granted a charter. It can take the property at its value as a going concern. And it must take its value as a going concern as a basis of any rates it may impose. Therefore, the corporation which denies this right of the public control could be obliged to part with its property on a basis which must be recognized in dealing with the corporation, which concedes this right in its charter. By making this concession the latter corporation propitiates public sentiment. It can always appeal to the consciences of the authorities, or of the public, against any attempt to regulate its rates while competition exists.

Public control of rates gives the public a sense of security against extortion. The corporation that concedes it is not attacked. It is not required to go into municipal campaigns to protect its interests nor to carry politicians on its pay-roll, nor to pay a portion of its gross earnings into the public treasury. Its charter is practically perpetual, for the argument that its rates are subject to public control allays fears of extortion and opposition to extensions.

When public control of rates is conceded, that control will not be arbitrarily exercised. When it is denied, the people will sustain the public authorities in resorting to extremes to bring the corporation under subjection.

It is believed the foregoing arguments furnish a sufficient basis for the conclusion that public service corporations should forbear to oppose public control of rates.

First: Because it is just to forbear; second, because it is expedient to forbear.

A CENTRAL STATION ELECTRIC PLANT OPERATED BY A GAS ENGINE.*

By J. C. Small.

In the summer of 1890 the last applicant came into our field and asked our city council for a franchise to operate an electric light plant. We introduced an ordinance for the same purpose on the same evening, and both were granted a franchise. We at once prepared to install the plant we now have in operation. As electrical engineers appeared to believe a gas engine too unsteady to furnish power successfully for an electric dynamo, to make doubly sure, our order for the necessary machinery included a jack shaft 14 feet long and inches in diameter, on the center of which was placed a 2,000 pound balance wheel, turned true and perfectly balanced. On one end of this shaft was placed a driving pulley and on the other end a clutch pulley, with the belt extending from the engine to the driving pulley and a belt from the clutch to the dynamo. This resulted in giving us an almost, if not absolutely, steady power.

We manufacture gas from what is known as second pool Pittsburg coal, and an average yield of 4¾ feet of gas to the pound. Nine hundred feet of this gas consumed in our engine per hour furnishes power for 60 6 8-10 ampere, 45 volt arc lamps, over 12 miles of wire. Our engine gives us very little trouble, is in good condition, notwithstanding its 10 years' use, and looks as if it might do service for 20 years more. Our lamps are seldom dark, as the following extract from the last 3 years' report will show:

Lamps dark in 1897, six hours; in 1898, three hours; in 1899, eleven hours.

I have been running steam engines for thirty years and gas engines for ten years, and in the light of this experience, were we installing power for any purpose, and espe-

*Condensed from paper read before Western Gas Association.

cially in connection with with a gas company, we would not for a moment think of accepting a steam engine free of cost instead of paying a fair price for a gas engine, and the larger either plant the more certain we should be of selecting the gas engine. We should do this for many reasons, the principal of which are economy and convenience.

I can see no reason for a gas company employing a steam engine; in fact, it is an admission that gas engines cannot do the work. A gas engine can do any work a steam engine can do, and do it more conveniently and more economically. We run them all over town for all purposes. We have two engines, a forty and twenty, running machine shops, and each of them have in connection an incandescent dynamo, furnishing their own light. Of course we put them both in; have been running two or three years, and give excellent satisfaction. Of course we had a lot of trouble early in our experience, but it was for want of knowledge, and if we had selected a man who was to run our plant, sent him to the shop where engines were being made and tested, and allowed him to remain there a month, it would have been money in our pocket; and if any member who wishes to install a plant will send his man here and let him run our plant for two weeks or a month under the supervision of our man, they will have no trouble, and we will extend the invitation to all to do so.

The average gas consumer cannot be expected to give the subject of gas consumption the consideration necessary to determine the advantages of its use, and the gas company should do it and be able to demonstrate its advantages without the loss of time or expense to the consumer, and should have employes who could and would assist the consumer in understanding its uses and advantages. This can best be done by the company taking its own medicine.

There can certainly be no doubt of the advantage to the average gas consumer of the use of the gas engine, the range, the water heater and the incandescent gas lamp, where a good quality of gas is furnished at fair price, both of which the public have a right to expect, and it is certainly largely to the interests of the company to meet this demand. And where it is cheerfully and faithfully done it results in the acquisition of friends by the company and a corresponding loss to the prince of all humbngs—Municipal Ownership.

STRENGTH OF CONCRETE WITH DIFFERENT PER CENT.* OF VOIDS FILLED.

By William A. Hawley and B. F. Krahl.

Two very common errors in writing the specifications for concrete are: (1) Screened stone is required when unscreened would be better; and (2) the proportion of mortar is fixed independently of the voids in the stone. Screened stone contains a greater percentage of voids than unscreened, requiring more mortar for the same volume of stone, and is, therefore, more expensive. It appears to be the universal custom to fix the proportion of mortar and broken stone independently of the per cent. of voids, and, therefore, the resulting concrete may be dense and strong, or the reverse, according to the percentage of voids in the stone.

The writers made a series of experiments to determine the strength of concrete having different relations between the voids and the mortar. Alpha American Portland cement, blue limestone, and drift sand were used. The proportions of the mortar were 1 to 3 by volume, loose. The per cent. of voids filled were 125, 100 and 75, respectively. The sand and cement were thoroughly mixed dry, and in such quantities as required for a complete set of cubes or bars at one time. The same size and grade of broken stone was used throughout the tests. Great care was taken to mix the mortar in the same manner each time, to use the same relative amount of water, and to make and tamp the concrete in the same maner.

To determine the crushing strength, 6-inch cubes were used; and to determine the transverse strength, bars 6x6x18 inches. The cubes and bars were allowed to remain in the laboratory for forty-eight hours, covered with a damp cloth, when they were removed from the molds, and placed under water to remain the specified time.

The results of the tests for the crushing strength of the cubes are shown in table I, and for the tests of the transverse strength of the bars in table II. Table III

*Abstract of a graduation thesis, prepared by these two members of class of 1900, at the University of Illinois, Champaign, Ill.

TABLE I.—Showing Crushing Strength of 6-in. Concrete Cubes.

Age.	Crushing strength. Per cent. of voids filled with mortar. 125. Approx. corresponding to 1—3—6. Total.	Lbs. pr sq.in.	100. Approx. corresponding to 1—3—7.5. Total.	Lbs. pr sq.in.	75. Approx. corresponding to 1—3—10. Total.	Lbs. pr sq. in.
7 days	52,100	1,447	42,480	1,180	$1,010	861
	56,730	1,576	45,630	1,269	31,940	887
	62,200	1,728	50,280	1,397	33,309	927
Mean	57,010	1,584	46,483	1,282	32,113	892
30 days	69,000	1,917	66,000	1,833	61,800	1,717
	65,000	1,806	64,200	1,783	54,200	1,505
	59,800	1,661	50,400	1,400	43,000	1,194
Mean	64,600	1,795	60,200	1,672	53,000	1,472
90 days	97,000	2,694	43,250	1,201	37,900	1,035
	93,000	2,583	38,000	1,055	28,250	785
	88,000	2,444	.....	.....	.....	...
Mean	92,666	2,579	40,625	1,128	33,075	910

TABLE II.—Showing Transverse Strength of 6x6x18-in. Concrete Bars.

Age.	Breaking load. Per cent. of voids filled with mortar. 125. Approx. corresponding to 1—3—6. Total.	Unit stress Lbs. pr sq.in.	100. Approx. corresponding to 1—3—7.5. Total.	Unit stress Lbs. pr sq.in.	75. Approx. corresponding to 1—3—10. Total.	Unit stress Lbs. pr sq. in.
7 days	2,780	347	1,790	224	1,750	219
	2,520	315	1,830	229	1,550	194
Mean	2,650	332	1,810	226	1,650	206
30 days	3,980	498	4,240	530	2,170	271
	3,800	475	3,910	489	1,860	232
Mean	3,890	486	4,075	509	2,015	252
90 days	4,820	602	5,000	625	2,000	250
	5,050	631	4,800	600	2,500	312
Mean	4,935	617	4,900	612	2,250	281

TABLE III.—Showing Relative Compressive and Transverse Strength of Different Grades of Concrete.

	Per cent. of voids filled with mortar. 125. Approx. corresponding to 1—3—6.	100. Approx. corresponding to 1—3—7.5.	75. Approx. corresponding to 1—3—10.
	Crushing Strength.		
7 days	123%	100%	69%
30 "	107%	100%	68%
90 "	228%	100%	81%
Mean	153%	100%	79%
	Transverse Strength.		
7 days	146%	100%	91%
30 "	96%	100%	49%
90 "	100.7%	100%	46%
Mean	115%	100%	62%

TABLE IV.—Showing Relative Costs of Different Grades of Concrete.

Material.	Price.	Per cent. of void filled with mortar. 125 Approx. corresponding to 1—3—6. Amt.	Cost.	100 Approx. corresponding to 1—3—7.5. Amt.	Cost.	75 Approx. corresponding to 1—3—10. Amt.	Cost.
Stone	$1.50 c. yd.	0.94yd.	$1.41	0.97yd.	$1.46	0.99yd.	$1.48
Sand	.75 "	.44 "	.33	.35 "	.26	.26 "	.23
Cement	3.00 barrel	.86bbl	2.58	.69bbl	2.07	.52bbl	1.56
Total cost			$4.31		$3.79		$3.24
Relative cost, %			114		100		86

shows the relative strength of each grade of concrete, and table IV the relative cost of a cubic yard of each.

By an examination of table III it is seen that an increase of 25 per cent. in the amount of mortar increases the crushing strength 53 per cent., and the transverse strength 15 per cent., or an average increase in strength of 34 per cent. With a corresponding decrease of 25 per cent. in the amount of mortar, there is a decrease of 21 per cent. in the crushing strength, and of 38 per cent. in the transverse strength, or an average decrease in strength of 30 per cent. From these results it is seen that the strength of concrete varies more rapidly than the per cent. of the voids filled. The maximum strength would probably be obtained when the concrete contains no voids and is a perfectly uniform and solid mass. In Baker's "Treatise on Masonry Construction," it is shown that when an amount of mortar equal to 100 per cent. of the voids is used, the voids are not entirely filled, and each stone becomes covered with a thin layer of mortar, thus forcing them apart, and increasing the amount of voids. To fill the voids entirely an amount of mortar equal approximately to 140 per cent. of the voids is necessary.

In order to obtain the relative cost of concrete, proportioned as in these experiments, table IV was computed. No allowance was made for the cost of labor; but as this would be nearly the same for all, the omission would not affect the relative cost.

According to table IV, the concrete, which has an amount of mortar equal to 125 per cent. of the voids, is the most economical of the concretes investigated; since for an increase in cost of 14 per cent., there is an increase in strength of 34 per cent., while for a decrease in cost of 14 per cent., there is a decrease in strength of 30 per cent.—Engineering News.

CURRENT INFORMATION.

Control of Municipal Employes.

An opinion has been rendered by three attorneys at Des Moines, Ia., concerning the validity of the Gibson resolution, which provides for the discharge on June 30 of all foremen and clerks in the board of public works who have not been appointed by the present council. The question involves a construction of the statutes defining the powers of the board of public works and the city council in respect to the employment of agents and laborers who carry on the work of the city. The attorneys hold that the board and the council have no right to appoint persons who can be called in any sense officers or permanent employes of the city. They shall be persons who are engaged in the actual construction, who

are carrying on improvements in progress in the city. . From the nature of the work they are to perform, their services would only be necessary when public works were in progress or work was necessary to be done of a public character in the city. From the nature of the case the city would not be expected to pay for such persons when not employed or when not necessary. When not otherwise restricted the city council is the paramount power in the city government; it controls the expenses and audits the bills presented. On that account it must necessarily have the right to restrict the number of employes that can be retained at any time in the department of the board of public works. They hold that the city council has the right to pass and enforce the resolution in question without any liability on the part of the city for such discharge.

Effect of Lake Drainage on Temperature.

The drainage channel is said by experts to have lowered the temperature of Chicago and considerable territory around it. The explanation offered is that the constant current flowing through the canals brings the cold water of Lake Superior to the southern part of Lake Michigan. The temperature of the water in the lake at Chicago is colder than it has been in past years, while the warm water that formerly lay stagnant in the Chicago river is replaced by a cold stream. Lieut. Wilson of the United States hydrographic office, Prof. Henry J. Cox, chief of the weather bureau and others make the same statement regarding the lowering of the temperature and give the same reasons for it.

A Federal Court Ruling on the Barrett Law.

In his final decree in the case of James Charles against the city of Marion, Ind., and the Warren-Scharf Asphalt Paving company, Judge Baker makes perpetual the injunction against the defendants restraining them forever from collecting any assessment against the plaintiff's property for improvement under the so-called Barrett law. As it now stands, the Barrett law is applicable to residents of Indiana, but non-residents owning property within the state have a chance to escape payment of assessments, as suits in which non-residents are involved may be adjudicated in the Federal court. Railroads and large corporations will gain the principal benefit from this conflict of authority, as many of them have their official residence in other states, though owning large property interests in Indiana.

Tests of Sewer Pipe.

A test of the resistance of sewer pipe to bursting has been made M. K. Miller, of Oakland, Cal. A pipe 6 in. in diameter, with a shell ¾ in. thick, made of clay and burned very hard, was used. Two lengths were placed end to end and wrapped several times with an 18 in. strip of burlap dipped in hot asphalt. No bells were used, the ends of the lengths being placed butt to butt. The ends of the sections were plugged and hydraulic pressure applied up to 200 pounds. In one case the burlap joint leaked slightly at 180 pounds, but no other defect of any kind was noticed in the pipes or joints, although the end plugs leaked some. Mr. Miller recommend the pipe for salt water distribution mains in Oakland.

Benefits Must Be Considered in Making Improvement Assesments.

The superior court of Marion county, Ind., handed down a decision June 7 in the case of Amos C. Heltzell vs. the city of Indianapolis. The judges held that the provision of the Indianapolis city charter in relation to assessments for local improvements is unconstitutional, because the law requires the costs of such improvements to be assessed upon the abutting property by a fixed rule, without regard to the special benefits accruing thereto, and that no provision is made in the law giving to the property owner a hearing on the question of benefits. The question in this case, they hold, is a very different one from that presented under the Barrett law, for under that law the city council is the authority that fixes finally the assessment, and it is the body before whom the hearing is had and the question of benefits considered. Under the city charter the board of works makes the final assessment, but it cannot consider benefits. The city council may take part of the cost out of the general fund; the board of works cannot, but must charge all to the abutting property, although that charge may be largely in excess of benefits.

Power to Tax Cannot Be Conferred Upon Municipal Commissions.

The Michigan supreme court rendered a decision June 5 which seemed to indicate that the water commissioners of Detroit would be deprived of the right to assess the owners of abutting property for the cost of laying water pipes. The court holds that the legislature cannot confer authority to

tax, to the exclusion of the common council, upon members of a commission appointed before the statute was enacted. The decision was rendered in the case of the Cook farm company, limited, against the city of Detroit. The decision is not final.

Liability for Damages from Sewage Disposal.

The New York supreme court rendered a decision recently in the case of Huffmire et al., vs. City of Brooklyn, for damage to an oyster bed due to sewage disposal, as follows: "Where a properly constructed sewer, erected by a municipality by legislative authority, discharges sewage through public waters and over land by third parties directly upon plaintiff's oyster bed, thereby destroying his oysters, such injury is not consequential and incidential to the maintenance of the sewer, but constitutes a direct invasion and appropriation of plaintiff's property for public use and entitles plaintiff to just compensation in damages therefor."

Sanitary Improvements at New Orleans.

The advisory board of engineers for the proposed sanitary improvements at New Orleans, La., recommends in its preliminary report, a number of lines of action, chiefly in the direction of investigations to secure data necessary for designing the proposed improvements. The first of these recommendations was to the effect that the general superintendent "be authorized to make a survey of the obstructions to sewage and water pipes now located in streets of the city." The board also recommended that the general superintendent be authorized to ascertain the value of the physical property of the New Orleans and the Algiers Water Works companies, and of the New Orleans Sewer company; the probable cost of an artesian well not less than 12 inches in diameter and 3,000 feet in depth; the possibilities of other river sources of water supply other than the Mississippi river. The feasibility and best methods of purifying water from the Mississippi river is also considered. The board believes that the amount and fineness of the suspended matter in this water renders "it more difficult to purify than the water supply of any other large city in the world." The board believes that the river water can be purified in a thoroughly satisfactory manner, and at a total cost within reasonable limits, yet it is of the opinion that investigations covering a year and costing not over $20,000, should be begun at once to determine what plan of treatment is best suited to the waters of the Mississippi river at New Orleans, and recommends that the general superintendent be authorized to select a competent assistant to serve temporarily as an expert in the immediate supervision of the needed investigations for water purification. The advisory board is composed of B. M. Harrod, chairman; Rudolph Hering, L. W. Brown, George W. Fuller, Thomas L. Raymond and A. C. Bell.

Regulation of Engineering and Surveying.

An act is pending before the Louisiana legislature which provides for the regulation of the practice of engineering and surveying in that state. The act proposes that the governor shall appoint two examining boards, one for civil and one for mechanical engineers. These examiners must be recommended by not less than twenty engineers or surveyors of established reputation. After the law goes into effect, any person desiring to practice engineering or surveying in the state must first present himself to this board and pass a satisfactory examination or have accepted by the examiners a diploma from an engineering school of good standing. This diploma may be disregarded, however. The applicant must be not less than twenty-one years old and be of good moral character. When a certificate is issued it must be recorded in the office of the clerk of the civil district court of the parish, and this record be indorsed on the certificate. The complete list of registered practitioners shall be published yearly. The examiners would receive $10 per day and expenses during session, and charge a fee of $5 for each certificate and $25 for each examination. The penalty for practicing without a certificate, or for attempting to give evidence as an engineer, is a fine of from $25 to $100 for each offense, or imprisonment of from thirty to ninety days. These certificates may be revoked for cause at any time by a majority of the board.

A Water and Light Contract Upheld.

A decision was rendered June 16 by Judge Lochran in the United States circuit court in the suit between the city of Little Falls, Minn., and the Little Falls Electric and Water company. The city of Little Falls in 1890 entered into a thirty-year contract with the water and light company, agreeing to pay a stated rental for a specified number of

hydrants for fire protection and lights for street illumination. The rental was paid until 1896, when the council passed ordinances repealing both contracts. An attempt to effect a compromise failed. The city then voted bonds to establish a municipal plant, but the validity of the bonds was questioned. Action was begun in court by J. C. Flynn, who complained that the contracts called for an unnecessary number of hydrants at an unreasonably high price, and that the contract ran for too long a period. The company demurred and Judges Baxter and Searle sustained the demurrer. The case was appealed to the state supreme court, and there the lower court was twice reversed and the case sent back for trial. The company then carried it to the United States court, where a decision in its favor on all points was rendered. Judge Lochran holds that the contracts are valid in all particulars; that the city council had authority to enter into them; that the term is reasonable and that the prices fixed in the contracts are not unreasonable; the council had no authority to pass the invalidating ordinances, and the company is entitled to its full rentals. Judge Lochran declines to enjoin the city from erecting a municipal plant, but it is not thought that one will be built as long as the present contracts run.

Water Rates Based on Tax Assessment.

In the suit of the Broken Bow Water Works company against W. H. Osborn, city assessor at Broken Bow, Neb., to compel him to assess property of the city at its actual value, Judge Sullivan of the district court, decided against the water company. The city entered into a contract with the water works company, several years ago, to pay the company seven mills on the assessed valuation per annum for hydrant rental. A rate per hydrant was agreed upon, there being apparently no question at the time but the seven mills would pay the fixed rate. For a number of years, however, it has been insufficient to raise the amount agreed upon per hydrant. As the assessor only assessed the property at one-fourth its actual value, which is customary over the state, the water works company sought to have the assessment raised to the real value of the property. The case will be appealed to the Supreme court.

New York's Water Diversion Law.

The Appellate division of the New York Supreme court has handed down a decision in the suit of the town of Hempstead against the city of New York. The suit was brought under the provisions of the so-called Wallace act, which provided that in case any corporation or municipality should divert fresh water streams of any county, which formerly had been navigable, the corporation or municipality was to be compelled to dredge the fresh water stream to the depth of three feet up to the limit of tide water, and that in case that was not done the township suffering by such diversion of water was to recover $50 a day damages. Presiding Justice W. M. Goodrich wrote the opinion which says the Wallace law is not retroactive; that it simply means that no such diversion of water as is complained of shall take place in the future. The decision will save the city of New York, nominally $5,900, and according to a statement by Assistant Corporation Counsel Luke D. Stapleton, it will save in reality $3,000,000.

Michigan's Foot Frontage Assessment Law Sustained.

In the suit of the Cass Farm company against the city of Detroit, Mich., claiming that the proceedings for the paving of Second-ave. were invalid because the law was unconstitutional, the assessment being by the foot frontage instead of according to benefits, it was decided in favor of the city of Detroit by the Supreme court, which holds that the law is valid. It was also contended that the board of public works anticipated the action of the council by making an estimate on the improvement; that there were irregularities in the bids, and that the work was not completed within the time required by law. The court held that these objections were not fatal.

Right to Asphalt Lands.

The Secretary of the Interior has decided in the suit of the Rock Creek Natural Asphalt company against the Gilsonite Roofing and Paving company, that the Gilsonite company, which made the improvements, has the prior right to lease the land and hold it. The question arose out of the construction of the Curtis bill, which gives the corporation in possession of the mine the preference in licensing from mineral trustees. In a contract between the

two companies the Rock Creek Natural Asphalt company granted the Gilsonite company the right to mine lime rock asphaltum from the Rock Creek company's mining claim. Under this contract the Gilsonite company developed a very valuable lime rock asphalt mine in the vicinity of Daugherty, and on account of its being actually on the land and operating the mine it claimed that under the Curtis bill it has a prior right to lease from the Indian mineral trustees. The case came up before Judge Townsend recently, who held that he had no jurisdiction in the matter.

Liability of an Electric Light Company for Damages.

The New York Supreme Court rendered a decision in favor of Paul N. Hertzog, as receiver of Joseph Ryan, in his suit against the Municipal Electric Light company, for negligence. Joseph Ryan formerly had a furniture store in Brooklyn, which was wired in 1892 for electric lights by the defendant company. The building was burned in January, 1893. The only insurance was $45,000, which was collected. Ryan soon after went into the hands of a receiver. The plaintiff held that an obsolete method of insulation was used. The court gives a verdict for $150,000.

New Methods of Street Cleaning in St. Paul.

In the hope of saving the cost of flushing the asphalt pavement and gain better results, the city of St. Paul, Minn., will substitute a new plan for this summer. The pavements will be scraped with rubber tools, after the plan followed successfully in German cities. The asphalt pavements in the business portion of the city will be sprinkled eight or nine times a day, and, while covered with water, the men employed to do the hand sweeping will scrape the surface with rubbers, thus removing the dirt and fine dust to the gutters, where it can be gathered up and hauled away. This saves part of the cost of keeping the catch-basins clean. The operation will be repeated several times a day.

Legal Right to Percolating Water.

Judge Oster of the Superior court, San Bernardino, Cal., recently handed down a decision in the case of McPherson and others against the Cucamonga Trust Land company in favor of the defendants. The case involved the right to a flow of water found in the soil in the vicinity of Cucamonga Springs. Fruit orchards in the vicinity of Cucamonga have been supplied for a number of years with water from these springs, and as the demand for water increased artesian wells were bored and pumping plants were installed in adjacent moist lands. During the last dry season the citizens of Ontario purchased some of the moist lands, bored and took water at a purchase price of $125,000. The plaintiffs allege that this use by Ontario was an abstraction of Cucamonga's supply and contended for the underground stream. The court decided that the water was percolating water and any one could take it and use it for whatever he pleased in any quantity provided he owned the land from which it is taken.

Sewage Disposal Along the Passaic.

The pollution of the Passaic river by sewage from the municipalities along its banks must cease before June 1, 1904. At a meeting of the New Jersey state sewage commission June 4, a resolution was adopted giving the offending municipalities four years, the maximum time asked for by the cities, in which to alter their system of sewage disposal. Factories will also be required to find other means of disposing of their waste than emptying it into the river. Less time will be required, however, for the factories to make the necessary changes than the municipalities.

Colorado's New Law Relating to Municipal Electric Corporations.

A ruling of some importance to municipal corporations was rendered recently by Judge Bailey of the district court of Colorado in the case of the Canon City Electric Light and Power company. At the last city election in April a vote was taken on the question of whether or not a franchise should be granted to the defendant company. The vote was almost unanimous for granting a franchise and the city council took action accordingly. In 1899 the Colorado legislature passed a law providing that all future municipal frachises should contain a clause that the property might be purchased by the city at the expiration of either ten or fifteen years. The company proceeded in disregard of this statute, however, and an injunction suit has, by the decision of Judge Bailey, resulted in declaring void the franchise granted by the city council, as it was the clear intent of the legislature that all kinds of franchises subsequent to the passage of the act of 1899 should preserve to the municipalities of the state the right of purchase

as stipulated and was intended to prohibit absolutely the granting in the future by cities and towns of unconditional franchises.

Pittsburg's Director of Public Works Deposed.

The office of E. M. Bigelow, director of public works, Pittsburg, Pa., was declared vacant June 11, and George W. Wilson, director of the department of charities, was chosen as his successor. The resolution calling for the vacation of the office by Mr. Bigelow was based on the recent report of the finance committee, which held that he was responsible for the defalcation of Samuel T. Paisley, superintendent of highways, in that he was negligent in his supervision of Paisley's accounts. The committee claimed that Paisley had defrauded the city of over $52,000 by padding the pay-rolls. The action of the council in deposing Mr. Bigelow is generally looked on, however, as the culmination of a fight in city politics. Mr. Bigelow's attorneys say that the council had no authority to oust him without trial.

A City's Right to Reduce Hydrant Rentals.

The Illinois supreme court handed down a decision June 21, affirming the decision of Judge Shaw in the case of the Freeport Water company vs. the city of Freeport. Judge Shaw decided that the city council had a legal right to lower the price of hydrant rental, notwithstanding the fact that the price had previously been fixed by a contract and franchise between the water company and the city.

Appeal of a Lighting Company.

The Media Electric Light and Power company of Media, Pa., has appealed from the decision of Judge Butler, reported in the June number of Municipal Engineering, requiring the company by mandamus to furnish electric light to J. W. Mercur at flat rates as requested by him instead of by meter. The decision of the higher court in this case will be awaited with interest by lighting companies.

Track Elevation in Chicago and Washington.

The Pennsylvania and Baltimore & Ohio railroads are preparing to elevate their tracks in Washington, D. C., and to erect new terminals. An ordinance recently passed by the Chicago common council involves a great amount of track elevation on the part of the Pennsylvania and Chicago & Western Indiana companies, while an ordinance is pending which will require the Milwaukee & St. Paul and the Northwestern and PanHandle companies to elevate their tracks in Kinzie-st. It is thought that little more will remain for the railroad companies to do in this regard in Chicago when this work is completed.

Examination of Structural Iron Workers.

The Chicago Civil Service Commission has announced that the examination for structural iron works that will take place July 24 will be open not only to Chicago tradesmen, but to those from all other cities. Secretary Coravan has received letters from artisans all over the country asking for particulars regarding the examination.

Crisis in German Cement Industry.

Reports from Bremen, June 13, stated that the crisis in the German cement industry was at its height and the only hope the manufacturers had was in exportation to the United States. The best cements have lost from 40 to 88 points or an average of 59 during the last six or nine months.

An Attempt to Depose Mayor Van Wyck.

A citizen's appeal for the removal of Mayor Van Wyck of New York City, based on the claim that he has violated his oath of office and transgressed the provisions of the charter, was laid before Governor Roosevelt June 2. The principal charge against Mayor Van Wyck is that he is interested financially in the American Ice company, from which the city buys large quantities of ice. He is also charged with negligence in permitting the dock commissioners to lease exclusive pier privileges to the American Ice company at lower rental than might have been secured from other bidders.

Demand for Damages from Electrolysis.

Suit was filed against the Indianapolis Street Railway company June 21, by the Manufacturers' Natural Gas company, wherein $50,000 is demanded as damages by electrolysis to the company's gas pipe mains, and an injunction is asked to compel the street railway company to construct immediately a suitable system by which the return electrical current may be allowed to pass back to its place of generation.

Use of Slag for Making Portland Cement.

In a paper read before the Iron and Steel Institute of Great Britain the utilization of blast furnace slag for making Portland cement according to the methods of recent German and Belgian works is discussed. The slag is first granulated by running it while hot into water, and after being dried is mixed about half and half with crushed limestone. About 35 per cent. of powdered slacked lime is added to this mixture, and it is then ground in the tube mills until the residue on a sieve of 5,000 meshes per square inch is only 2½ per cent., and the residue on a sieve of 30,000 meshes is only 12½ per cent. The powder from the tube mills is mixed with about 8 per cent. of water and made into brick by machinery. These bricks are dried by being stacked in the open air and then burned in special kilns. The paper says:

"Each furnace consists, in its essential part, of a series of rings, each 1 to 1¼ inches in thickness, 8½ feet inner diameter, and 18 inches in hight. These rings are provided outside with ribs, and placed in such a way, one above the other, that the vertical ribs cover one another, thus forming little vertical channels, all round, in which the air circulates from below the top, like a chimney, thus continually cooling the cast-iron rings from outside, and preventing them from getting overheated. The materials to be burnt are in direct contact with the cast-iron rings, no lining of any kind being provided for. There are eighteen such rings, put one above the other, the upper rings—where the greatest heat occurs—being hooped at the joints. The top of each furnace is provided with a cone and a chimney made of sheet iron, 3 feet in diameter and 30 feet in hight. The cone has four charging-doors, which can be closed by sheet iron covers as soon as the charging is done. At a depth of 12 feet from the top the inner diameter of the furnace is lessened to nearly half its inner horizontal section, and on this place provided with a double row of tuyeres to admit compressed air, this arrangement having for its object to burn any carbonic oxide or carburretted hydrogen gas arising from below as completely as possible, as well as to concentrate the heat exactly where it is required, viz., on the place where the formation of the clinker is to take place. Each furnace has a capacity of twenty-five tons of clinker each twenty-four hours. The clinker is ground in ball mills and finished in tube mills."

Firemen Refuse to Sweep Streets.

An ordinance was recently introduced in the select branch of councils, at Altoona, Pa., reguiring the firemen to sweep the streets during their odd hours. The firemen in all the houses have served notice that should the measure pass councils and become a law, they will immediately throw up their position, not a driver, hoseman or truckman remaining in the department.

Cost of Maintenance of Vitrified Clay Water Mains.

The report of John McComb, city engineer at Little Falls, N. Y., states that the vitrified clay water main which was built in 1886-87, at a cost of $45.544, has been quite expensive to maintain. The main has a length of 5.63 miles and the annual cost of its maintenance has been as follows: 1887, $962; 1888, $2,103; 1889, $554; 1890, $81; 1891, $1,174; 1892, $185; 1893, $492; 1894, $5,790; 1895, $3,888; 1896, $926; 1897, $24; 1898, $8, making a total of about $16,187. In addition to this about $1,800 more was expended in 1899 in cementing cracked lengths and in repairing 338 feet of the line with cast iron pipe.

Employment for Draftsmen.

Civil service examinations will be held in all cities having a local board of examiners, July 10 to 14, inclusive. The examination on July 10 and 11 will be for structural steel draftsmen to be employed in the navy department at Washington, D. C. On July 12 to 14, the examination will be for architectural and structural steel draftsmen to be employed at Boston, Mass. Persons who desire to compete for these positions should apply at once to U. S. Civil Service Commission, Washington, D. C., for application forms 304 and 375, which should be properly executed and filed with the commission.

A British Engineer's Report on Wood and Asphalt Pavements.

In a report on the comparative durability of wood and asphalt pavements, D. J. Ross, city engineer of London, prefers asphalt to wood and recommends its use for the new pavement of Holborn viaduct, the traffic on which is about 12,000 vehicles in twelve hours. He says that ordinary deal block pavements have been used in the city of London since 1871, the blocks being mostly 3x4 ins. by 6 ins. deep, generally creosoted, laid with bitumen joints on Portland cement foundation. In all cases the contractors have agreed to maintain these pavements for two years without charge and for fifteen years additional at a fixed charge, varying with the local conditions. He says that in his experience "the carriageways in streets of considerable traffic have had to be relaid at intervals of

from five to seven years." As to Australian hard woods in the city proper, except for 304 sq. yds. laid in October, 1893, none have been down more than four and one-half years, and most of those laid only three years or less. All such blocks laid in 1896 or earlier are reported as either in "fair condition" or "showing signs of wear," the blocks laid in 1893 being "rounded by the traffic." In all about 25,000 sq. yds. of hard wood blocks have been laid. Outside the city proper hard wood blocks laid in Tottenham Court Road in December, 1892, "had worn very unevenly" by June, 1899, or in six and one-half years, besides which "the noise caused by the traffic was very great, and the pavement was being extensively repaired."

Nearly all of the main thoroughfares of the original city are paved with asphalt, under seventeen years of maintenance contracts, and in some of the minor streets this pavement has lasted for thirty years. On Holborn viaduct it has been down seventeen years; in London Wall, twenty years; Lothbury, twenty-three years. In the Poultney it was down nineteen years before it needed repairs, and in Princes street its life was twenty-two years.

Municipal Reports.

Annual report of the City Engineer of the city of Providence, R. I., for the year 1899. Otis F. Clapp, City Engineer.

A large part of the report is devoted to meteorological observations, which are probably kept more elaborately at Providence than by the engineering department of any other city. Mr. Clapp gives the ordinary cost of laying water pipes with all appurtenances except hydrants and iron, at $35 per long ton, as follows: For 4-in., $0.556 per ft.; 6-in., $0.815 per ft.; 8-in., $1.098; 10-in., $1.408; 12-in., $1.809; 16-in., $2.730; 20-in., $3.811; 24-in., $5.052; 30-in., $7.195; 36-in., $9.683. The report shows that the daily average use of water for service was 455 gallons, and per capita, 53 gallons. Information is given as to the details of the work in constructing precipitation tanks.

Annual report of the City Engineer of the city of Minneapolis, Minn., for the year ending Dec. 31, 1899. G. W. Sublette, City Engineer.

Mr. Sublette regards the principal engineering work remaining to be done in Minneapolis as sewer construction, and recommends that each year the trunk lines be extended as much as possible. During 1899 much attention was given to bridge construction. Mr. Sublette reports that the cost of cleaning sewers was reduced from $1.90 per cubic yard in the previous year to $1.38. A number of illustrations appear in the report showing bridge construction and the cleaning of snow from the streets.

Meeting of the American Society of Municipal Improvements.

The American Society of Municipal Improvements, composed of municipal officers, will hold its next meeting in Milwaukee, Wis., Aug. 28-31. This date is somewhat earlier than previous meetings and the principal reasons for a meeting so early in the fall were the low railroad rates secured for that time and the exceedingly fine climate of the northern place of meeting at that season of the year. During the last week in August the national encampment of the G. A. R. will be held in Chicago and the rate of one fare for the round trip has been granted by the Central Passenger Association. The delegates to the American Society of Municipal Improvements will therefore receive the benefit of this low rate. The reports from the officers and chairmen of committees are most encouraging and point to a meeting of unusual interest and an exceedingly large attendance.

Technical Meetings.

The American Society of Civil Engineers has accepted the invitation of the Institution of Civil Engineers to hold its convention of 1900 in London at the house of the Institution. The opening session will be held July 2. Other meetings will be arranged. The Institution of Engineers wil hold its annual conversazione in the Guildhall of the city of London, to which function the American engineers and their families are invited.

At a meeting of the Western Society of Engineers, June 20, the subject of discussion was a waterway twenty feet deep, from the great lakes to the Gulf of Mexico. James A. Seddon read a paper on "Reservoirs and the Control of the Lower Mississippi," which covered the subject from Cairo to the gulf.

The fourth annual convention of the American Park and Out-door Art Association was held in Chicago, June 5, 6 and 7. Among the papers presented was one by Frederick Law Olmsted, Jr., on "Advertising Bill-Boards," in which he took a determined stand against placing big colored signs in residence districts. He said: "A city could be made a beautiful place if the municipal

authorities would adopt the proper means for making it so. Such things as unsightly statues placed in improper places, advertising bill-boards and other nuisances should be subjects of crusades."

Personal Notes.

A. C. Moltz has been elected city engineer at Hannibal, Mo.

C. J. Seiler has been appointed city engineer at Summit, N. J.

Alvin Hillis has been elected city engineer of Marinette, Wis.

Homer A. Collar has been appointed city engineer at Lansing, Mich.

J. Arden Powell has been elected city engineer at Gloucester, N. J.

D. P. LeFevre has been re-elected city engineer at Cumberland, Md.

A. D. Dimock has been appointed assistant city engineer at Seattle, Wash.

George W. Beggs has been appointed assistant civil engineer at Reading, Pa.

Charles Greever has resigned his position as city engineer at Leavenworth, Kas.

C. H. Sharp has been elected superintendent of the water department of Manchester, Va.

William R. Chase has been re-elected city engineer for the third term at Portland, Ore.

Thomas R. Crowell has been elected city engineer, to succeed George W. Hays, at Lebanon, Pa.

Charles B. Cooke has been elected city engineer at Wheeling, W. Va., to succeed A. L. White.

Rodney A. Swift has been appointed city engineer to succeed C. C. Small, resigned at Auburn, Me.

William Gavin Taylor has been appointed acting city engineer of Medford, Mass., to succeed F. Howard Barnes, resigned.

W. E. Garrigues, formerly of Pittsburg, Pa., has opened an office as chemical engineer at 1123 Broadway, New York City.

William H. Gosborn, county bridge engineer and former city engineer of Fort Wayne, Ind., died in that city June 9, aged 65 years.

William T. Hunt, president of the New Jersey state sewerage commission is in Europe studying sewage disposal in European cities.

Charles K. Robinson has resigned his position as treasurer of the Barber Asphalt Paving company, New York City, on account of ill health.

Prof. C. L. De Mott of the Lynchburg high school, has been elected city engineer of Lynchburg, Va., to fill the unexpired term of the late L. P. Rodes.

Joseph W. Shirley has been appointed chief engineer of the municipal topographical survey commission, of Baltimore, Md., to succeed George W. McCreary.

Frederick W. Kafer, a recent graduate from the civil engineering school of Princeton university, has been appointed instructor in the civil engineering department.

Allen J. Fuller has been appointed general superintendent of the bureau of water, Philadelphia, to succeed Frank L. Hand, who was recently made chief of the bureau.

Marshall O. Leighton has established an office in Clair, N. J., as consulting expert in engineering and biographical subjects relating to public health and sanitary administration.

Edward L. Cox has resigned his position as general sales agent of the Kelley Island Lime and Transport company, Cleveland, O., to accept a similar one with the German-American Portland cement works of LaSalle, Ill.

Albert Kelsey, past president of the Architectural League of America, delivered a lecture recently on "Municipal Improvement" under the auspices of the Pittsburg Architectural club during its exhibition in the Carnegie art galleries.

Morris Knowles, Assoc. M. Am. Soc. C. E., has been appointed assistant engineer in charge of testing station, improvement and filtration of the water supply of Philadelphia. William G. Toplis has been appointed bacteriologist and Geo. E. Thomas chemist.

Edward Pell Folger, assistant engineer of New Rochelle, N. Y., has opened offices at 13 Columbus-place, New Rochelle, for the general practice of civil engineering and landscape architecture. Mr. Folger will retain his official position with the city. Chas. W. Leavitt, Jr., New York City, has been engaged for consultation on landscape architecture.

John C. Haskell, former superintendent of water works at Lynn, Mass., committed suicide by shooting June 12. Mr. Haskell was city engineer for twelve years previous to his election to the water board and was former president of the New England Water Works Association. He had been acting strangely for some time and it was believed he was insane.

Mr. D. B. Luten, C. E., has tendered his resignation as instructor on roads and pavements of Purdue university. Mr. Luten will be the manager of a newly-formed company which has acquired patents for the construction of concrete arches. Mr. Luten enters upon his change of occupation under circumstances generally auspicious. Not only are the prospects for his venture bright, but he was married on June 20 to Miss Edith Hull of Lafayette.

MACHINERY AND TRADE.

The Septic Tank In Sewage Purification.

Mr. John N. McClintoch, C. E., president of the American Sewage Disposal company, in a statement regarding the designing and construction of sewage disposal works, as well as works for the purification of water, calls attention to the fact that it is possible to render pure water from the most polluted sources. He says that the septic tank, if properly constructed, will remove 90 per cent. of the pollutions from sewage.

This is done by the so-called anaerobic bacteria, or germs of decay and putrification, which do their work of liquefying the solids of the sewage without the aid of oxygen. The last patent covers the double filtration of the effluent from the septic tank. The first of the two filters of coarse material, removes 90 per cent. of the impurities of the septic tank effluent, or 90 per cent. of the impurities of the original crude sewage. This first filter may be constructed as a contact bacteria bed, on the surface of which is applied intermittently a certain amount of the septic effluent until the bacteria bed becomes thoroughly saturated, when it is allowed to stand one or more hours, and afterwards discharges automatically by a syphon upon the second or intermittent filter. The second filter removes 90 per cent. of the impurities which escape from the bacteria beds, or 99.9 per cent. of the original impurities. The patents of Mr. McClintoch provide for the ventilation and covering of the tanks and filter beds. As the effluent from the first filter is colorless, odorless and tasteless, and remains for many months without further putrification, the cover or roof of the second filter may be omitted.

Mr. McClintoch says: "The septic tank may have a capacity of from twelve to twenty-four hours' flow of sewage. The bacteria contact beds may have an area of one acre for a daily flow of 1,000,000 gallons, with a depth of five feet. The intermittent filter may have the area and depth of the bacteria bed. To obtain greater purification than 99.9 per cent., the intermittent filter may be enlarged. The effluent at this stage is about as free from pollution as the water of the Merrimac river at Lawrence, Mass., when it is taken to the filter plant before being pumped into the reservoirs to be used for domestic purposes by the city. The necessary purification of the Merrimac river water is obtained by filtering through five feet of sand at the rate of 3,000,000 gallons per day per acre. Our system provides mechanical arrangements for the drawing off of the septic tank and for the care and the disposal of the sludge; but as a matter of fact there is very little sludge, if the separate system of sewers is used, and surface drainage kept out of the sewers, the solid organic substances disappearing in the septic tank, and the filters acting efficiently for a very long time. Our model sewage disposal works at Brentwood, N. H., were constructed in 1895, the first of the kind in the world, and have been in continuous and successful operation ever since, save occasionally when the plant was undergoing repairs.

"The cost of constructing disposal works differs according to the locality. The tanks are simply concreted cellars with a roof, and may be built of masonry, concrete or brick. Their shape is immaterial; they may be long, narrow and shallow. The roof may be of concrete, brick or lumber. The filtering material may be in place or may be put in place. It is usually easier to bring filtering material to the sewage disposal works than to carry sewage to the filtering material. The bacteria of the contact beds and of the intermittent filter are called acrobic or nitrifying, and are dependent on the supply of fresh air for their continued effectiveness. The bacteria of the septic tank liquefy the solids of the sewage; the nitrifying bacteria convert the impurities in solution into their inorganic elements. The nitrifying bacteria are supported by the impurities from which they originate, and, having served their purpose, are oxidized by the air which passes through the filter to the under drains. The American Sewage Disposal company of Boston have perfected a mechanical contrivance to divert the flow of sewage automatically from one bacteria bed to another, thus giving one the chance to aerate while the second is in use. By the septic tank we give 50 per cent. purification; by the septic tank and bacteria bed, 99 per cent.; by the septic tank, bacteria bed, and intermittent filter, 99.9 per cent, or absolute purification, if necessary."

Specifications of Paint.

Architects, consulting engineers, owners and persons interested in the subject of protective paint for steel structures, will receive a handsome card illustrating several eighteen-story steel structures upon which Dixon's Silica-Graphite Paint has been used, if they will send their address to the Joseph Dixon Crucible company, Jersey City, N. J. The card also contains suggestions for specification of the paint, and its well-known durability has led to its specification and use upon many immense steel viaducts, bridges and manufacturing plants all over the world.

Screening Machinery.

The Western Machinery & Supply company, 157 La Salle-st., Chicago, have put on the market their vibratory hand screen and separator. By the mere turning of a crank by hand the screen is operated and handles the material in a very economical manner. The device is adapted for use in mines, quarries, stone yards, asphalt works, brick yards, sand and gravel pits, and in fact every place where a sizing of material in small capacities is required. The machine is portable and easy and convenient to operate.

Street Brooms and Street Sweeper Rolls.

Probably the oldest manufacturers of brushes and brooms in the western country are Joseph Lay & Co., located at Ridgeville, Ind. The present company was established in 1872, but long before this, as far back as

the forties, the father of the present owners manufactured brooms and exchanged them in the larger cities for nails, lumber, etc., which were in turn exchanged to farmers for produce. At that time one kind of broom was considered sufficient for all purposes, but now the company makes all kinds and styles, including bass, rattan, bamboo and steel wire. They make a specialty of street brooms and street sweeper rolls and have a large trade in this department. They have the facilities of a large factory, perfectly equipped with modern machinery, including everything that will in any way reduce the cost of production. The present members of the company are Joseph Lay and S. C. Lay.

New Factory of the Globe-Wernicke Company.

The Globe-Wernicke company of Cincinnati has recently completed a large plant in Norwood, a suburb of Cincinnati, for the manufacture of its book cases. The site on which this plant is located comprises fourteen acres, fronting 920 feet on Carthage-ave. and 600 feet on Ross-ave. The main factory building is of red pressed brick in three wings, each three stories high and 75x250 feet in size. The auxiliary buildings consist of dry kilns, storage for lumber, power house and veneer mill. The total floor area is about 200,000 sq. ft. The present power plant has a capacity of 300 horse power, to which 600 additional horse power may be added. The equipment consists of a 300 horse power medium speed, heavy duty engine directly connected with a 200 K. W. generator and two 300 horse power water tube boilers. The entire plant will be equipped with the Warren-Webster vacum heating system. There are three large electric freight elevators and a system of automatic sprinklers for fire protection. One of the features is a large cistern of 500,000 gallons capacity, built on the French plan of solid concrete. This will supply the plant with soft water and afford a reserve for fire protection. The other sources of water supply are a deep well, a steam pump and the city water works. The transmission of power and light throughout will be electric. There will be a large shower bath with hot and cold water in the basement for the use of the employes. The plant will be modern in all its equipments and is especially designed for the manufacture of Globe-Wernicke elastic bookcases. It will afford empolyment to about 300 persons and will have a capacity of three car loads of book cases per day. In addition to this plant the company will continue to operate its Cincinnati factory, containing about the same floor area as the Norwood factory for the manufacture of elastic filing cabinets, desks, stationers' goods, etc.

NEW PLANT OF GLOBE-WERNICKE COMPANY AT NORWOOD, OHIO.

All About Stone.

The Cleveland Stone company of Cleveland, O., has just issued one of the most elaborately illustrated and beautifully printed pamphlets that has come to this office. It is indeed a very fine representation of art in printing. The text gives a vast amount of information about the qualities of stone and particularly regarding the superior merits of the stone from the seventeen quarries of the Cleveland Stone company. The illustrations also show it in use for various purposes, such as buildings, bridges, street curbing, flagging, etc. Much valuable information is also given regarding the various uses of stone. The

book is one that engineers, architects and contractors everywhere will appreciate and it will be found to be both ornamental and useful. Copies of it can be obtained by addressing the company at Cleveland.

Recent Inventions.

No. 650,143, May 22, 1900. Pavement, Thomas Bailey, New York, N. Y. Sheet metal piers are driven into the foundation and connected by sheets of metal, the whole being covered by concrete, asphalt or the like.

No. 650,169, May 22, 1900. Sewer, Merritt C. Conway, Syracuse, N. Y. The walls of the sewer are formed of peculiarly shaped interlocking cellular tiles.

No. 650,710, May 29, 1900. Roadway, Hugh Dunlop, Sydney, New South Wales. A layer of wooden blocks is covered by two layers of plastic material, the lower layer consisting of blue metal screenings, Portland cement, caustic soda, resin and calcined clay, and the upper or wearing layer composed of bitumen, boiled linseed oil, resin, Stockholm tar, calcined clay, blue metal screenings and sand.

No. 651,096, June 5, 1900. Fireproof Window, Daniel B. Badger, Winchester, and Arthur C. Badger, Boston, Mass. The casing and sashes are formed of sheet metal.

No. 651,301, June 5, 1900. Filter for Purifying Sewage, etc., Walter M. Ducat, London, England. An aerobic bacterial filter is provided with covering walls and a roof some distance from the bed to provide a surrounding air space and protect the filter beds so that the temperature thereof may not fall to a point where the action of the bacteria becomes suspended.

No. 651,326, June 5, 1900. Electrical Hose-Signaling Apparatus, William Fowler, Colorado Springs, Col. A fire hose, each section of which is provided with a continuous electrical conductor and with suitable couplings, by means of which a continuous conductor may be formed from one end of the hose to the other so that signals may be transmitted.

No. 651,391, June 12, 1900. Filter, Annie W. Sellers, Wilmington, Del., executrix of George H. Sellers, deceased, assignor to the United States Filtering and Purifying company, Camden, N. J. A filter in which the filtering process is an upward one, the impure water being forced upward through the filter bed.

No. 651,566, June 12, 1900. Water Works and Filtering System, William A. Freise, Newark, N. J. A system of distributing mains, water reservoir, pumps and pressure filters, so arranged that the filters may be cleaned or flushed with filtered water.

Trade Notes.

CEMENT.

The plant of the Michigan Portland Cement company, Quincy, Mich., is running its full capacity.

The plant of the Elk Rapids Portland Cement company., Elk Rapids, Mich., is being rapidly pushed to completion.

The N. C. Browder company, Hickory, N. C., contemplates erecting a plant for making cement tile for sidewalks.

The warehouse of the C. A. Brockett Cement company, Kansas City, Mo. was destroyed by fire June 17. Loss $15,000.

The General Cement company, Jersey City, N. J., has been incorporated by Charles N. King, William J. Lamb and S. H. Jacobs.

A plant will be located at Battle Creek, Mich., by I. K. Forsythe, of that city, for the manufacture of cement posts, cement railroad ties, etc.

The Calumet Portland Cement company, 3901 Lowe-ave., Chicago is erecting two cement mills for the manufacture of sand cement.

A large tract of land at Rossville, near Chattanooga, Tenn., has been purchased by W. P. P. Moross, representing eastern capital and a Portland cement plant will be established.

The Ajax Portland Cement company, has been incorporated under the laws of New Jersey by H. W. Meen, Millard W. Baldwin, Clifford W. Perkins, Edward B. Hawkins and Alfred G. Brown.

The Utica Hydraulic Cement company, Utica, Ill., has, since the loss of one of its mills by fire, been handicapped in filling orders. The mill will be rebuilt, however, when the company will be in a position to fill all orders.

The Portland cement plant of the Great Northern Portland Cement company, which will be located at Baldwin, Mich., will be one of the largest in the world. The company, which is capitalized at $5,000,000, has acquired more than 6,000 acres of marl and clay lands in that vicinity. The plant will be located at North lake and connected with the town of Baldwin by an electric street car line. The estimated output will be 12,000 barrels daily. Among the officers of the company are the following: George Anderson, president of the McLellan & Anders Savings Bank, Detroit; Burton W. Yates, capitalist, Detroit; Alexander B. Scully, president Scully Steel and Iron company, Chicago.

The Canadian Portland Cement company has been formed and incorporated to take over the interests of the Rathbun Cement company of Napanee and Maribank, the Beaver Portland Cement company of Maribank and the St. Lawrence Cement company of Montreal, Canada. The officers and directors of the new company are: President, E. W. Rathbun, Deseronto; managing director, F. G. B. Allan, Napanee Mills; James Dobson, Philadelphia; M. J. Haney, W. D. Matthews, B. B. Osler, C. A. Masten, Toronto; C. J. Webb, Philadelphia.

The old James Cement plant at Wilbur, N. Y., has been purchased by Daniel H. Zoller. The mill has not been in operation for a number of years.

The members of the Chamber of Commerce, Muskegon, Mich., are endeavoring to induce the Newaygo Portland Cement company to remove its plant from Newaygo to Muskegon.

The American Carbonated Cement company, Baltimore, Md., has been incorporated to manufacture and deal in cement. R. Thomas Phillips, attorney, Baltimore.

The Cummings Cement company, Akron, N. Y., will build a new warehouse.

The directors of the Nazareth and Portland Cement company voted to sell their plant to New York parties for $600,000.

A consolidation of the leading lime companies in Illinois and Wisconsin, under the title of the Wisconsin Lime & Cement company, has been effected and ten Wisconsin plants have been absorbed. The officers of the new company are: President, Allen B. Cook; vice-president, N. J. Druecker; secretary, E. B. Myers; treasurer, W. L. Woods; directors, Allen B. Cook, N. J. Druecker, E. B. Myers, J. B. Tuthill, Adolph Loefflers, Charles Ruedebusch and A. H. Halaman. The firms included in the consolidation are: Cook & Brown Lime company, Orensby Lime company, Gray, Tuthill & Co., Haleman-Loeffler company, W. J. Neebes & Co., N. J. Druecker, Charles Ruedebush, Wisconsin Lime company.

State Geologist Blatchley says there is enough marl in the lakes in Northern Indiana to furnish cement for the next hundred years. Of the group of eight lakes in Kosciuski county, he made soundings in five and found marl enough in two to pay for working it, and traces of it in the other three. Lake James, in which the largest deposit was found, is 375 acres in extent.

The National Building and Supply company, New Orleans, La., delivered its first consignment of 1,000 barrels of Portland cement, June 19, to be used in the concrete work in the construction of the power house for the United Railway and Electric company at Baltimore, Md.

WATER.

The New York Filter Mfg. Co., 15 Broadst., New York City, has been awarded the contract for the complete equipment of the Watervliet arsenal with filters of 400,000 gals. capacity. Also a contract for a 12,000,000-gal. filtration plant for the Tintern Manor Water Co., Redbank, N. J.

The Lockport & Fane Power and Water Supply Co., Lockport, N. Y., has been incorporated to develop and employ hydraulic and electric power and supply pure and wholesome water to cities, villages and towns. The directors of the company are: Henry J. Pierce and Burt Van Horn, Buffalo; W. T. Ransom, John A. Merritt, H. I. Ranson and T. E. Ellsworth, Lockport; W. B. Rankine, Niagara Falls.

Newly incorporated water companies: Mountain Water Co., Milton, Pa.; Masontown Water Co., Masontown, Pa.; Consumers' Water Co., North Huntington twp., Westmoreland Co., Pa.; Main River Water Co., San Francisco, Cal.; Evergreen Water Co., Whittier, N. Y.. Mt. Vernon Water Co., San Bernardina, Cal.; Elk Lick Midland Water Co., Midland, Md.; W. O. W., Water Co., Fresno, Cal.; John T. Carpenter Water Co., El Modena, N Y.; Nome Water Co., San Francisco, Cal.; City Water Co., Cedar Rapids, Ia.; Rancheria Water Co., San Bernardino, Cal.; Ioamosa Water Co., San Bernardino, Cal.; Wilmington Water Co., Los Angeles, Cal.

LIGHTING.

The Norfolk Heat, Light and Power company, Norfolk, Va., has purchased a site and will build an electric plant to supply electric light in opposition to the Williams Syndicate company. W. D. Pender is resident manager.

The Kansas City Gasoline Light company has filed articles of incorporation under the laws of Kansas. The directors are: G. E. Burton, J. E. Hersey and Chas. Darnell, Kansas City, Kas.; C. M. Bush, Warren M. Smith, Kansas City, Mo.

The Yates Electric Light and Power company, of Yates county, N. Y., has been incorporated to supply electricity for producing light, heat and power for Penn Yan, Jerusalem, Milo and Benton. The directors are Henry B. Pierce, Walter Cox, Henry T. Howell, Frederick P. Delafield, Frederick W. Longfellow, New York City; Cassius L. Haskell, West New Brighton.

The General Construction company, Ft. Wayne, Ind., was incorporated June 26 for the construction, maintenance and operation of electric light plants, water works and street railway systems. The incorporators are H. M. Geiger, Ft. Wayne; Senator W. H. Watson, Charlestown; Thomas W. Perry, Jeffersonville. A branch office will be maintained in Jeffersonville.

Newly incorporated electric companies: Electric Light and Heat company, Old Forge, Pa.; Empire Lighting company, Poughkeepsie, N. Y.; Consumers' Gas and Electric company, Davenport, N. Y.; Winchester Gas and Electric Light company, Winchester, Va.; Montpelier Light and Water company, Montpelier, Ind.; Springfield Electrical Mfg. company, Springfield, Mass.; Maumee Valley Electric and Power company, Toledo, O.; Elmira Water-Light company, Elmira, N. Y.; Miller-Knoblock Electric Mfg. company, South Bend, Ind.; West Lorne Electric Light company, Toronto, Ont.; Masontown Electric Light, Heat and Power company, Masontown, Pa.; Waterloo Electric Light and Power company, Waterloo, N. Y.; Sayville Electric company, Islip, N. Y.

MISCELLANEOUS.

The Rock Lime Stone Crusher near Mitchell, Ind., burned June 9. Loss, $5,000.

The Iowa Pipe and Tile company, Des Moines, Ia., contemplates enlarging its plant.

The Glen Mills Crushed Stone company, Camden, N. J., has been incorporated to quarry stone, by H. C. Rheinback, W. Ryan and E. Walton.

The Minnesota Crushed Stone company, Minneapolis, Minn., has been incorporated by F. Guderian, P. S. Snyder and William P. Berry of Minneapolis.

The Crescent Stone company, Bloomington, Ind., has been incorporated by Fred

Matthews, G. K. Perry, Henry F. Perry, Thomas C. Perring and William N. Matthews.

The street committee at Houghton, Mich., has been given power to purchase a rock crushing outfit.

A paving brick factory will be operated at Barry, Ill., by C. H. Chilton, according to press reports.

The county commissioners of Springfield, O., are reported as considering the purchase of a stone crusher.

The bids received for furnishing road rollers, rock crushers and screens to the city of Lewiston, Idaho, were rejected.

The Interlocking Web Tile company, Syracuse, N. Y., has been incorporated by John Dunfee, Alexander Cowie and Merritt Conway.

The Grand Ledge Sewer Pipe company has been absorbed by the American Clay Mfg. company, incorporated under the laws of New Jersey.

The Conway Contracting company has been incorporated by James Conway of Newark, N. J., William Hanna, East Newark, and Joseph Randall, Kearny.

The Ritch Contracting and Stone company, Greenwich, Conn., has been incorporated under the laws of West Virginia by W. T. Ritch, W. R. Ritch, J. R. Ritch and F. O. Green.

George S. Roberts of Attica, Ind., and Harry D. Perkins of Danville, Ill., have formed a partnership as Perkins & Roberts and will construct cement sidewalks. They are located at Danville.

The River Falls Crusher company, Newhope, Pa., has commenced operations. It manufactures crushed and Belgian blocks. The officers of the company are: President, Franklin Eastburn; treasurer, Robert W. Welch; secretary, Charles T. Eastburn.

The Spencer Stone company, Sullivan, Ind., has been incorporated with P. H. Blue as president and Wake Giles as secretary and treasurer. The Merom Gravel company of Sullivan is the principal stockholder.

The Miami Stone company, Detroit, Mich., has been incorporated to quarry and deal in stone and other material used in paving and road building. The incorporators are Fred J. Bleakley, David E. Henneman and Frank C. Wells.

The Galesburg Paving Brick company of Galesburg, Ill., was almost entirely destroyed by fire recently. The fire originated in the dry house and was communicated to the machinery building, destroying both. The loss is estimated at $40,000.

The United States Paving company, which recently incorporated under the laws of New Jersey, has acquired the plants of Boston and Syracuse paving companies. The company also controls the asphalt deposits of the island of Pyrataneles. The company's daily capacity is 10,000 yards of asphalt, and additional plants will be erected as fast as the business warrants. The officers of the new company are: President, W. H. Bates; vice-president, W. L. Gillett; secretary, George I. Robinson, jr.; directors, W. H. Kimball, George R. Ferons, G. N Cutting, C. B. Duffy, G. W. Moses, W. S. Cramp and J. A. Sullivan. The company was organized to do paving work of all kinds in the smaller cities.

George Lemaux, Jr., and M. B. Stratton, of Ridgeville, Ind., have bought the business of the Indianapolis Brush Manufacturing company, which will be enlarged under their management, and special attention will be given to the manufacture of brooms and other appliances for street cleaning. Mr. Lemaux and Mr. Strattan are known as successful business men and begin their new venture under very promising auspices.

The S. Howes company, Silver Creek, N. Y., manufacture a packer which is in general use in the United States in the large cement works. The machine has been on the market for some years and is very strongly commended by those who use it. Some improved changes have been made in it, and manufacturers claim for it superior merits. An advertisement of the packer appears in Municipal Engineering.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Detroit, Mich.—This city has $260,000 worth of repaving work under way.

Kenton, O.—Mayor J. B. Fletcher, some of the members of the city council and several citizens visited Indianapolis, Ind., recently for the purpose of inspecting street pavements.

Cortland, N. Y.—The contract with Warner & Quinlan of Syracuse for paving Grofon-ave. has not been executed owing to some technical points in it that give promise of being construed in such a manner as to give the city expense and trouble.

Indianapolis, Ind.—The board of works decided recently to temporarily excuse the Indiana Bermudez Asphalt company from resurfacing New Jersey-st., from Massachusetts to Ft. Wayne-ave.; to extend the guarantee period two years from July 9, and to put the company under a $10,700 bond to resurface the street within the two years. The Bermudez company agrees to make temporary repairs now. The contract is something new, and it is claimed the property-owners will profit by it.

CONTEMPLATED WORK.

Toledo, O.—Sealed bids are asked until July 9 for improving Forrer-st. J. E. Cunnell, cy. clk.

Carthage, O.—Bids are invited until July 9 for improving portions of five streets. L. Hall, vil. clk.

Denver, Col.—Sealed bids are asked until July 3 for the North Denver grading dist. No. 1. B. P. W.

Delta, O.—Sealed bids are asked until July 3 for 18,000 sq. yds. of brick paving. F. W. Zerman, vil. clk.

Ridgefield, N. J.—Bids are asked until

July 10 for improving Edgewater-ave. C. B. Wilson, boro. engr.

Wauseon, O.—Bids are asked until July 2 for improving Leggett and Superior-sts. A. S. Bloomer, cy. clk.

Wyoming, O.—Sealed bids will be received July 11 for 12 mls. of macadam streets. W. A. Clark, vil. clk.

Cincinnati, O.—Bids are asked until July 5 for paving Fisher-ave. Geo. F. Homes, clk. Bd. Pub. Service.

Carrington, N. D.—Bids are asked until July 2 for grading roads in several districts. J. D. Faxon, co. audt.

Findlay, O.—Sealed bids will be advertised until July 26 for paving W. Main Cross-st. with brick. Cy. clk.

Pittsfield, Mass.—Bids are asked until July 3 for building and grading 8,400 ft. of county road. County Com'rs.

Ft. Dodge, Ia.—Bids will be received about July 10 for 2,756 sq. yds. of brick paving. C. H. Reynolds, cy. engr.

Paterson, N. J.—Bids are asked until July 2 for constructing various road improvements. John Blauvelt, chmn. rd. com.

Valparaiso, Ind.—Bids are asked until July 7 for building certain roads in Boone twp. Jos. S. Fulton, chmn. co. com'rs.

Oshkosh, Wis.—Sealed bids will be received until July 21 for paving Algoma-st. with brick. Frank Monahan, chmn. B. P. W.

Clinton, Ia.—Sealed bids are asked until July 2 for macadamizing part of the Elvira road. L. Rutenbeck, co. audt.

Adena, O.—Bids are asked until July 3 for grading and macadamizing the Adena and Harrisville free turnpike. M. N. Moore.

Mankato, Minn.—Sealed bids are asked until July 5 for laying cement walks. C. Kyser, I. D. Webster, H. I. Parry, com. Bd. of Education.

Chillicothe, O.—Sealed bids are asked until July 2 for paving Paint-st. with vitrified paving brick or block. W. A. Wallace, cy. clk.

Greensburg, Ind.—Bids are asked until July 5 for building free gravel roads in Salt Creek and Jackson township. Coleman T. Pleak, co. audt.

Council Bluffs, Ia.—Bids will be received July 8 for 48,000 sq. yds. of brick paving on sand foundation. S. L. Etmyre, cy. engr.

Pontiac, Mich.—Bids will be received from July 1 to 10 for about 8,500 sq. yds. of brick or asphalt block paving. Wm. J. Fischer, cy. engr.

Quincy, Ill.—Sealed bids are asked until July 2 for paving Twelfth-st., from Broadway to Locust, with brick. John T. Hummert, pres't. Bd. Local Imp.

Findlay, O.—Sealed proposals are invited until July 5 for building stone and plank sidewalks in certain streets. Frank C. Ray, cy. clk.

Hornellsville, N. Y.—Sealed bids are asked until July 2 for constructing about 4,950 sq. yds. of brick paving. F. W. Dalrymple, cy. engr.

Fort Wayne, Ind.—Sealed bids are asked until July 5 for paving Webster, Main and Third-sts. with asphalt, asphalt block, brick or creosoted block. B. P. W.

Danville, Ill.—Sealed bids are asked until July 2 for constructing 37,035 ft. of free gravel roads in Liberty township. A. T. Dooley, chmn. Bd. co. comrs.

Gas City Ind.—(Special)—Sealed bids will be received until July 6 for the construction of about 3½ miles of brick and cement sidewalks. Wm. P. Alexander, cy. clk.

Hamburg, N. Y.—Bids are asked until July 2 for improving White's Corners road No. 2, between Buffalo and Hamburg. Edw. A. Bond, state engr. and surv., Albany, N. Y.

Coshocton, O.—Bids are asked until July 13 for 14,000 sq. yds. of brick or asphalt pavement on 6 inch concrete and 7,030 lin. ft. of curbing. F. F. Wagner, clk.

Washington, D. C.—Sealed bids are asked until July 7 for grading certain streets and avenues, aggregating about 120,000 cu. yds. H. B. N. McFarland, chmn. dist. com'rs.

Michigan City, Ind.—Sealed proposals are asked until July 9 for paving Wabash-st., from Boston-st. to Barker-ave., with brick with stone curbing. Edward Heisey, cy. clk.

Conneaut, O.—Sealed bids are asked until July 18 for brick paving, stone gutters and curbing in Main, Washington and Harbor-sts. W. F. Stanley, mayor; J. L. Risley, clk.

Des Moines, Ia.—Bids are asked until July 9 for about 4,332 sq. yds. of brick paving on 6 inch concrete and 6,800 lin. ft. of curbing on W. Eleventh-st. G. A. Eberhart, chmn. B. P. W.

Alexandria, Ind.—Bids will be received July 13 for paving Washigton, N. Harrison, Polk and Canal-sts. with brick. The bids received June 15 were considered too high. J. S. Humphrey, cy. engr.

Marinette, Wis.—Sealed bids are asked until July 11 for 19,510 sq. yds. of brick paving, 3,110 sq. yds. of macadam paving, 8,180 ft. of curb and 8,600 cu. yds. of excavation. A. L. Hillis, cy engr.

Port Chester, N. Y.—Bids are asked until July 9 for paving with brick portions of Grace Church-st., about 2,020 sq. yds., and Westchester-ave., about 5,300 sq. yds. J. A. Kirby & Sons.

Portsmouth, O.—Sealed bids are asked until July 18 for paving Eleventh-st., from Offnere to Chillicothe-st., with brick or blocks, including curbing, sewer pipe, catch basins, iron inlets, manholes, etc. E. K. Walsh, cy. clk.

Washington, D. C.—Separate sealed bids are asked until July 18 for cut stone, Portland cement, sand, broken stone, broken bricks, common red pressed and select red hand made bricks, etc. John Stephen Sewall, lieut. engrs., 735 N. Capitol-ave.

CONTEMPLATED WORK.

Marion, Ia.—Brick street paving is contemplated.

Streator, Ill.—Paving is contemplated for N. Bloomington-st.

Shreveport, La.—An issue of bonds for paving is favored.

Beardstown, Ill.—The street paving question is being agitated.

Bozeman, Mont.—The council contemplated macadamizing Main-st.

Milford, Ill.—Paving is proposed for Jones-st. and Western-ave.

Cortland, N. Y.—New bids will be asked for paving Groton-ave.

Canton, Ill.—About five blocks of N. Third-ave. will be paved.

Maryville, Mo.—Paving is contemplated for the main business streets.

Green Bay, Wis.—Macadam paving has been petitioned for on Cherry-st.

Baltimore, Md.—Belgian block repaving is proposed for North-ave.

Crookston, Minn.—The question of street paving is being considered.

Montclair, N. J.—An ordinance has been passed to macadamize several streets.

Zanesville, O.—An ordinance to pave Vine-st. with brick has been passed.

Victoria, Tex.—This town voted to issue $45,000 bonds for road improvements.

Dansville, N. Y.—This town has voted to issue bonds for macadamizing Main-st.

Baltimore, Md.—An ordinance is pending for repaving Towson-st., South Baltimore.

Taylorville, Ill.—A resolution has been adopted to pave the public square.

Erie, Pa.—Ordinances have been passed for brick paving in a large number of streets.

Fairbury, Ill.—Paving is contemplated for four blocks of Locust-st. Mayor Barnes.

Elliott, Pa.—An ordinance has been passed to issue $23,000 street improvement bonds.

Plymouth, Ind.—A resolution has been adopted to pave Michigan and Laporte-sts.

Farmington, Mo.—The sum of $6,000 has been appropriated for improving county roads.

Matton, Ill.—About ten miles of concrete walks will be laid. W. E. Miller, cy. engr.

Duluth, Minn.—The question of laying a stone sidewalk on E. Third-st. is being agitated.

Geneva, N. Y.—Macadam, brick or creosoted block paving is urged on High and Milton-sts.

Fremont, O.—A resolution has been adopted to pave E. State-st. this year.

Ashland, O.—The citizens on Cleveland-ave. want the street paved next year.

Hancock, Mich.—The question of paving Quincy-st. is being agitated. Mayor Scott.

Grand Rapids, Mich.—Warren-ave. will be paved and Canal-st. repaved with asphalt.

Greenwich, B. C.—About $16,000 will be expended this summer on streets and sidewalks.

Holendel, N. J.—Bids will be asked for a new stone road from this town to Marlboro.

East Orange, N. J.—The sum of $10,000 has been voted for grading and curbing S. Clinton-st.

Sault Ste. Marie, Mich.—A boulevard along the south side of the water power canal is proposed.

Rochester, N. Y.—Central-ave. will be paved with Medina block. Theodore S. Pulver, cy. clk.

Bangor, Me.—The city engineer has been authorized to advertise for bids for paving Main-st.

Denver, Col.—A petition is being circulated for macadam paving for the Capitol Hill district.

Hamburg, N. Y.—The village trustees have voted to expend $2,000 for street improvements this year.

Richmond, Va.—An appropriation of $11,305.30 has been allowed for paving certain sidewalks.

Norfolk, Va.—A resolution has been passed appropriating $21,694 for paving Butte-st. with asphalt.

Avalon, Pa.—The borough has voted to issue $20,000 bonds for paving California-ave. and Home-st.

Kenton, O.—Plans and specifications have been prepared for macadamizing High-st. J. P. Dungan, cy clk.

Winnipeg, Man.—Cumberland-ave. will be paved with asphalt, according to press reports. C. J. Brown, clk.

Middletown, O.—Resolutions have been passed for brick paving on Third and Main-sts. Frank Stevens, cy. clk.

Albany, N. Y.—Specifications have been prepared for paving Livingston-ave., Ontario, Odell and Osborne-st.

Rushville, Ill.—The question of building a cement walk in the park is being considered. Mayor Hartman.

Ottawa, Ont.—The Ottawa Improvement commission is planning to construct considerable macadam paving.

Aurora, Ill.—An ordinance has been passed to pave Downer-place with asphalt. Em. Pfrangle, cy. clk.

Burlington, Ia.—A resolution is in council for paving Main-st., from South to Wade, with vitrified brick.

Clinton, Ia.—The property-owners on Eighth-ave. have petitioned for macadamizing from Third to Fourth-sts.

Seattle, Wash.—Plans and specifications for street improvements have been completed by R. H. Thomson, cy. engr.

East Liverpool, O.—The council has voted to improve Pennsylvania-ave. and Pleasant-st. J. N. Hanley, cy. clk.

Scranton, Pa.—A resolution has been submitted to pave Cedar-ave., from Willow to Birch, with vitrified brick.

Buffalo, N. Y.—The common council has decided to pave a large number of streets with asphalt, brick and macadam.

Oxford, O.—A resolution has been adopted to build cement or sandstone sidewalks in Church-st. J. A Kennedy, clk.

Ravenna, O.—Resolutions have been passed to improve Meridian and Oak-sts. and Cleveland-ave. S. J. Post, vil. clk.

New Haven, Conn.—Another petition is being circulated asking for brick paving in Temple-st., from Chapel-st. to Congress-ave.

Orange, N. J.—The city engineer has been authorized to prepare plans and specifications for paving Main-st. with asphalt. Mayor Stetson.

Bridgeton, N. J. — (Special)—William Sharp, cy. surv., says that bids are being asked for paving a portion of the streets with asphalt block.

Durand, Mich.—The street committee has been authorized to purchase paving brick and such other material as is necessary for brick crosswalks.

Warrensburg, Mo.—The property owners on Holden-st. have petitioned for brick paving in the business districts. John H. Wilson, pres't. coun.

Madison, Wis.—An ordinance has been introduced requiring that all sidewalks hereafter constructed shall be built of concrete or vitrified brick. Mayor Hoven.

Pittsburg, Pa.—Director Geo. W. Wilson has set aside the new specifications of Mr. Bigelow and decided to use those under which the streets have been paved since 1892.

Hamilton, O.—Bids will be received about the last week in July for paving N. and S.

Second and N. Third-sts. with asphalt, asphalt block or brick. M. O. Burns, cy. clk.

Springfield, Mass.—The board of supervisors is reported as having voted to pave several streets with vitrified brick. Main-st. and perhaps Oak-st. will be macadamized.

New Albany, Ind.—Ordinances have been passed and objections will be heard July 16 for paving upper Sixth-st. and an alley with brick. Edward Crumbo, mayor; Thos. M. McCulloch, cy. clk.

San Francisco, Cal.—The board of public works has been requested to build concrete walks in all streets and avenues lying between Point Lobos-ave. and Lake-st. and First and Sixth-aves., in Richmond.

Philadelphia, Pa.—The city council passed a bill June 14 to appropriate out of the loan authorized in 1898, $300,000 for resurfacing asphalt streets and $100,000 for repairs to paved streets, grading, etc.

Greensburg, Pa.—The street committee has decided to recommend that the borough engineer be instructed to survey all the streets of this town and submit an estimate of the probable cost of paving them.

Syracuse, N. Y.—The paving of W. Belden-ave., Wallace and N. Franklin-sts., with asphalt, asphaltum or brick is contemplated. Plans have been submitted for paving Warren, E. Geneva, N. West and other streets and avenues.

Kearny, N. J.—Notice of intention has been ordered published to pave Highland-ave., from Johnston to Woodland-ave., with asphalt. A resolution has been adopted instructing the street committee to advertise for bids for a road roller.

St. Joseph, Mo.—A resolution has been adopted instructing the street committee and engineer to furnish estimates and plans for paving State, Main, Pleasant and Broad-sts. City engineer Rockliffe is advertising for bids for paving Felix-st. from Third to Eighth, with asphalt. Mayor Combe is opposed to macadamizing the streets in the eastern part of the city.

San Francisco, Cal.—Contracts will probably be let in July for improving Sixth-st. between Folsom and Harrison. The board of public works has directed City Engineer Grunsky to review and revise all of the specifications for the making and repairing of street work and sidewalks, for the purpose of insuring better pavements; particularly in the business districts. The use of paving brick is being considered.

CONTRACTS AWARDED.

Coshocton, O.—Adams Bros., of Zanesville, secured the contract for paving Second-st., for $12,683.

Cambridge, O.—The contract for brick paving on concrete was awarded to A. G. Pugh, of Columbus, for $32,804.

Cincinnati, O.—J. M. Quill, of this city, was awarded the contract for macadamizing Grandin-ave., for $14,567.

Cohoes, N. Y.—The contract for paving Howard-st. has been awarded to the Hasting Paving company, of New York City.

Peoria, Ill.—James S. Allen secured the contract for paving Indiana-ave. with brick, June 14, at $1.32¾ a sq. yd.

Princeton, Ind.—The contract for improving roads in Columbia township has been awarded to Reaves, Beloit & Co. for $46,960.

Detroit, Mich.—The contract for paving Park-place with brick was awarded to George E. Currie, at $1.77 a sq. yd.

Washington, Ia.—The contract for 6,000 ft. of cement walks was awarded to George H. Carton & Son of Oskaloosa, Ia.

Allegheny, Pa.—Ott Bros. have been awarded a contract for paving with Ligonier block on gravel foundation and slag walk for $11,109.

Boston, Mass.—F. Stuart & Son, Newton, Mass., secured the contract for road building in West Boylston and Bolyston for $14,425.

Asbury Park, N. J.—J. F. Shamley, of Trenton, secured the contract for building a stone road from this town to Marlboro for $15,280.

Sullivan, Ind.—P. Hipskind & Sons, of Wabash, have been awarded the contract for nine and one-half miles of macadam roads in this county for $22,900.

Champaign, Ill.—The contract for paving W. Illinois-st. with brick was awarded, June 20, to J. W. Stipes. Postum block will be used.

Rome, N. Y.—The Alcatraz Paving company secured the contract for paving W. Dominick-st., from George to Jay, with Syracuse brick, for $11,858.

West Hartford, Conn.—The contract for macadamizing New Britain-ave. was awarded to the B. D. Pierce, Jr., company of Bridgeport at $1.43 a sq. yd.

Flint, Mich.—The contract for paving E. Kearsley-st. was awarded, June 12, to Lynch & Lynch for $10,667.42, Malvern brick will be used.

Moline, Ill.—The contract for fourteen blocks of brick paving was awarded, June 11, to the Tri-City Construction company of Davenport, Ia., for $32,790.

Wilkesbarre, Pa.—The contract for building the Humlock's creek and Shickshinny turnpike has been awarded to P. M. Gilligan for $7,250.

Baltimore, Md.—The contract for paving St. Paul-st., from Twenty-fifth to Thirtieth, with asphalt has been awarded to T. S. Filbert & Sons at $2.18 a sq. yd.

Fulton, N. Y.—Seymour & Newkirk secured the contract for laying macadam roadway and cement walk at the west end of the bridge between Volney and Granby for $5,290.

Hartford, Conn.—The contract for paving Albany-ave., Lewis, Spruce and Church-sts. with asphalt was awarded, June 13, to the Southern New England Paving company for $14,476.80.

Brazil, Ind.—Esler & Peters of Terre Haute submitted the lowest bid, June 13, for paving Main-st., at $3.39½ a lin. ft. for Indiana paving brick and $3.44 for Excelsior brick.

Waukegan, Ill.—The contract for paving West, Genesee and Julian-sts. and Grand-ave. with macadam was awarded to James Bairstow & Co. of Chicago at 50 cts. a sq. yd., or $20,910.

Milwaukee, Wis.—The Warren-Scharf Asphalt Paving company secured the contract for asphalt paving, as follows: E. Water-st., $2.25; an alley, $2.21; Cedar-st., $2.27; Knapp-st., $2.18.

Grand Rapids, Mich.—The contract for

re-paving Canal-st., from Pearl to E. Bridge, with asphalt, was awarded to the Northern Paving and Construction company, June 11, for $18,496, ten-year guarantee.

St. Paul, Minn.—The Barber Asphalt Paving company was the lowest bidder, June 21, for paving Kent, Summit and Arundel-sts. and Nelson-ave. with asphalt, and Fielding & Shepley for paving Summit court alley with brick.

Camden, N. J.—B. F. Sweetern & Son of this city were awarded the contract, June 19, for curbing, flagging and guttering, repaving, leaks in sewers, furnishing inlets, pipes, etc., for the ensuing year.

La Crosse, Wis.—R. C. Houston & Co. of Chicago secured the contract for 62,000 sq. yds. of brick paving and 23,000 lin. ft. of curbing, June 18, for $102,454. Metropolitan block and Kettle river curbing will be used.

Bristol, Tenn.—The Virginia Paving company has been awarded the contract for paving sections of Sixth and Fourth-sts. in this city, and for Cumberland, Lee, Front and Moore-sts. in Bristol, Va., with vitrified brick, at $1.35 a sq. yd.

Wapakoneta, O.—Henry Ganz, of Lima, was awarded the contract for paving the business portion of Auglaize-st. with brick for $13,731, and the Ayres Asphalt Paving company of Zanesville the residence portion with asphalt for $25,413.

Spokane, Wash.—The contract for paving Post and Sprague-sts. with asphalt has been awarded to the Alcatraz Asphalt Paving company, for $31,772, maintenance for ten years, $2,750, and $46,433, maintenance for ten years, $3,477, respectively.

Philadelphia, Pa.—Asphalt paving contracts aggregating $100,000 were awarded June 14 to Richardson & Ross, the Pennsylvania Asphalt company, the Vulcanite Paving company and the Alcatraz Paving company at prices ranging from $2.17 to $2.32 a sq. yd.

Alexandria, Ind.—(Special)—S. J. Branden of this city secured the contract for paving Madison-st., and Porter, Bowen & Hadley, of Tipton, for Clinton-st. The bids for the other streets were rejected as too high and bids readvertised, to be received July 13. J. S. Humphrey, cy. engr.

Sioux City, Ia.—Bids were received June 19 for paving Pearl, Douglas and Pierce-sts. with brick as follows: Barber Asphalt Paving company, $2.12, exclusive of extras; Western Paving and Supply company, $2.20; Bermuda Asphalt Paving company, $2.22; Alcatraz Paving company, $2.24. The council rejected the bids as too high.

Louisville, Ky.—Paving contracts were awarded June 21 as follows: Ormsby and Kentucky-sts., Green River Asphalt company, Warren county asphalt, $1.49 and $1.69 respectively; vitrified brick paving in a number of streets, George W. Gosnell, $12.45 per square of 100 square feet; reconstructing Breckenridge-st., R. B. Park Asphalt company, Logan county asphalt, $1.55 a square yard.

Toledo, O.—The contract for paving Rockingham-st., between Collingwood and Fulton-sts. with asphalt block, was awarded to John McMahon for $8,908.31 and for Fifteenth-st. from Monroe to Jefferson with Trimble block to C. W. McKinney for $2,727.70. Bids were received June 11 for paving a number of streets with asphalt block, asphalt or brick, but the contracts were not awarded.

Lincoln, Neb.—The bids received for $14,795 square yards of asphalt paving in district No. 6 were as follows: Barber Asphalt Paving company, five years guarantee, $1.80; 10 years, $2.05; sand filler, 65 cents; stone, $1.50; concrete, $5; resetting curb, 15 cents a lineal foot; Alcatraz Asphalt company, five years guarantee, $1.80; ten years, $2.04; sand filled, 85 cents; stone, $1.75; concrete, $5; resetting curb, 20 cents.

Buffalo, N. Y.—The American Contracting company was awarded the contract, June 20, for repaving Broadway with asphalt, for $35,250. Other contracts awarded for repaving are: W. Utica-st., asphalt, Barber Asphalt Paving company, $12,669; E. Ferry-st., met. block brick, William H. Barker & Co., $9,900; Indiana-st., asphalt, Barber Asphalt company, $4,275; Chestnut-st., asphalt, American Contracting company, $4,175.

St. Louis, Mo.—Annual contracts for street repairs and materials were awarded, June 18, to Gottlieb Eyermann, H. Ruecking & Co., Heman Construction company, Bambrick-Bates Construction company, J. E. Perkinson, Mueller Coal, Heavy Hauling and Transfer company, St. Paul Sand and Gravel company, Harry F. Heman, John A. Lohrum, Hill-O'Meara Construction company, Morris Rich, John Hoge, St. Louis Stone Masons' Quarry and Building association, Stifel & Ruckert and Skrainka Construction company.

Syracuse, N. Y.—Bids have been received for asphalt paving as follows: E. Genesee-st., Asphaltina Construction company, Clinton block, $14,387; Empire Contracting company, 112 East Jefferson-st., $14,442; Syracuse Improvement company, Warner building, $13,534; Warren-Scharf Asphalt Paving company, Nottingham building, $14,107. Grape-st., Waren-Scharf Asphalt Paving company, with Trinidad sheet asphalt, $1,615.40; Syracuse Improvement company, with Trinidad sheet asphalt, $1,678.70; Empire Contracting company, with Alcatraz sheet asphalt, $1,710.70; Asphaltina Construction company, with Trinidad sheet asphalt, $1,720.50; John W. Bustin, with brick, $1,407.70.

New York City.—Bids were received June 15 for asphalt paving contracts amounting to between $1,000,000 and $2,000,000 in twenty-six streets in Manhattan and Brooklyn, including the asphalting of Broadway from Fourteenth to Forty-second-sts. and of One Hundred and Twenty-fifth-st. from Third to Eighth-aves. The bids were as follows: Broadway—National Asphalt company, $4.79 a yard for asphalt, 58 cents for relaying old pavement; Atlantic Alcatraz Asphalt company, asphalt $5.38, relaying 64 cents; Barber Asphalt company, asphalt $5.61, relaying 60 cents; Sicilian Asphalt company, asphalt $5.77, relaying 58 cents; Warren-Scharf company, asphalt $6, relaying 72 cents. One Hundred and Twenty-fifth-st.—Asphalt Construction company, asphalt $3.37, relaying pavement 40 cents; Atlantic Alcatraz company, asphalt $3.55, relaying 42 cents; Barber Asphalt company, asphalt $3.49, relaying 48 cents; Sicilian As-

phalt company, $4.07, relaying 45 cents; National Asphalt company, $4.30, relaying 58 cents. The bids on the other contracts ranged from $2.39 to $2.53 a sq. yd.

Joliet, Ill.—(Special.)—Bids were opened June 25 for the construction of asphalt pavements on Union-st. and Third-ave. The Union-st. work comprises (1) 8,500 sq. yds. of paving, (2) 5,000 ft. curbing, (3) 2,500 cu. yds. excavation, (4) 800 ft. resetting curb, (5) 2 catch basins, (6) four manholes, (7) 13 cu. yds. of extra concrete. The bids were as follows: Bermudez Asphalt Paving company, (1) $1.79, (2) .37½, (3) .25, (4) .12, (5) $28, (6) $28, (7) $4; total, $18,021. R. F. Conway company, (1), $1.70, (2) .68, (3) .01, (4) .15, (5) $20, (6) $20, (7) $3; total, $18,154. Western Paving and Supply company, (1) $1.81, (2) .38, (3) .28, (4) .15, (5) $30, (6) $30, (7) $4; total, $18,327. Ayres Asphalt Paving company, (1) $2, (2) .42, (3) .30, (4) .15, (5) $35, (6) $35, (7) $4; total, $20,222. Barber Asphalt Paving company, (1) $2.30, (2) .50, (3) .30, (4) .10, (5) $30, (6) $20, (7) $4; total, $23,062. Warren-Scharf Asphalt company, (1) $2.40, (2) .41, (3) .38, (4) .13, (5) $35, (6) $25, (7) $3.90, total, $23,724.70. The contract was awarded to the R. F. Conway company, of Chicago. The work on Third-ave. comprised (1) 6,000 sq. yds. of paving, (2) 2,500 ft. of curbing, (3) 3,000 ft. excavation, (4) 800 ft. resetting curb, (5) 3 catch basins, (6) 3 manholes. The bids were as follows: Bermudez Asphalt Paving company, (1) $1.79, (2) .50, (3) .25, (4) .12, (5) $28, (6) $28; total, $13,004. R. F. Conway company, (1) $1.70, (2) .71, (3) .30, (4) .15, (5) $20, (6) $20; total, $13,115. Western Paving and supply company, (1) $1.81, (2) .50, (3) .28, (4) .15, (5) $30, (6) $30; total, $13,250. Ayres Asphalt Paving company, (1) $2, (2) .47, (3) .30, (4) .15, (5) $35, (6) $35; total, $14,405. Barber Asphalt Paving company, (1) $2.50, (2) .50, (3) .36, (4) .10, (5) $30, (6) $20; total, $16,360. Warren-Scharf company, (1) $2.40, (2) .41, (3) .38, (4) .13, (5) $35, (6) $25; total, $16,849. This contract also was awarded to the R. F. Conway company, of Chicago.

SEWERS.

CONTRACTS TO BE LET.

Portsmouth, O.—Bids are asked until July 18 for a sewer. E. K. Walsh, cy. clk.

Roanoke, Va.—Bids are asked until July 3 for several sewers. J. H. Wingate, cy. engr.

Evansville, Ind.—Bids are asked until July 13 for a sewer. George W. Swearington, clk. B. P. W.

Youngstown, O.—Sealed bids are asked until July 7 for a sewer in Plum-st. C. E. Cross, clk.

Oshkosh, Wis.—Sealed bids are asked until July 12 for a sewer in Seventh-st. Frank Monahan, chmn. B. P. W.

Fond Du Lac, Wis.—Sealed bids are asked until July 2 for a sewer in Main-st. F. A. Bartlett, cy. clk.

Des Moines, Ia.—Bids are asked until July 7 for 643 ft. of sewer in Mulberry-st. G. A. Eberhart, chmn. B. P. W.

Prospect Park, Pa.—Bids are asked until July 6 for eight-inch terra cotta sewers. Frank McGinnis, chmn. sewer com.

Napoleon, O.—Sealed bids are asked until July 7 for building 6,512 ft. of sewers. C. N. Schwab, engr.; U. V. Fiser, clk.

Summit, N. J.—Bids are asked until July 3 for 1,325 ft. 8-6 in. pipe sewers in two streets. Daniel C. Day, cy. clk.

Northampton, Mass.—Bids will be received until July 2 for building sewers on N. Main, Orchard and Myrtle-sts. and Glenwood-ave. Sewer com.

Green Bay, Wis.—Bids are asked until July 5 for building a 60-in. 2-ring brick sewer on Eleventh-st., with catchbasins. George J. Schwartz, pres't. com. coun.

Chicago, Ill.—Sealed bids are asked until July 10 for the construction of the Thirty-ninth-st. conduit from Halstead to Butler-st. L. E. McGann, com. pub. wks.

Rochester, Minn.—Sealed proposals are asked until July 2 for 4,736 feet of eight-inch sewer on Franklin, Second and First-sts., with lampholes, manholes, etc. A. F. Graham, cy. clk.

Toledo, O.—Sealed bids are asked until July 2 for cylindrical pipe sewers in Sherman and Bowman-sts and until July 16 for a cylindrical pipe sewer in Buffalo-st. John E. Connell, cy. clk.

Tomahawk, Wis.—Sealed bids are asked until July 3 for furnishing sewer pipe as follows: 2,258 feet 12 inch; 160 feet 10 inch; 1,312 feet 20 inch; 500 feet 8 inch; 96 feet 12 Y's, inch Y's 4-8 to 20 inch Y's; 4-8 to 12 inch Y's. James Kelley, cy. clk.

CONTEMPLATED WORK.

Rock Falls, O.—Plans for a sewerage system have been made.

Dubuque, Ia.—A sewer in Rose-st. is proposed. L. M. Langstaff, cy. rec.

St. Mary's, O.—The council has been petitioned to build a sewerage system.

Waupaca, Wis.—The question of building a sewerage system is being agitated.

Irvington, N. J.—The town council has passed the joint sewer ordinance.

Kansas City, Mo.—The completion of the Turkey creek sewer is proposed.

Hamilton, O.—Resolutions for a storm and a sanitary sewer have been passed.

Troy, O.—The estimated cost of building a sewerage system is $25,000.

Pittston, Pa.—An ordinance is pending providing for a sewer on Vine-st.

Concord, Mass.—This town voted to appropriate $10,000 for building new sewers.

Ilion, N. Y.—A system of sub-drainage for this city has been decided upon.

Flint, Mich.—A sewer will be constructed in one street and one rebuilt in another.

Montclair, Colo.—A sewerage system to connect with the Denver system is proposed.

Portland, Me.—The estimated cost of a brick sewer in Sanford-st. is $9,290.

Lake Linden, Mich.—The question of building a sewerage system will be revived.

Elizabeth, N. J.—A trunk sewer in Walnut-st. is contemplated; estimated cost $14,000.

Anamosa, Ia.—A resolution has been passed for a sanitary sewer. W. D. Shelan, mayor.

Oswego, N. Y.—Resolutions have been passed for sewers in several streets. E. A. Cooke, clk.

Hazelton, Pa.—An ordinance for the sale of $22,000 bonds for building a sewer has passed.

Warren, O.—The board of health contemplates ordering this city to build a filtration plant.

Newburgh, N. Y.—A resolution has been passed to build sewers in Mill-st. and Robinson-ave.

Barberton, O.—Plans for a general storm water sewer are being prepared. H. W. Alcern, engr.

Ouray, Colo.—Plans for a sewerage system will be drawn by Hiram Phillips, C. E., St. Louis, Mo.

Sag Harbor, L. I.—The question of bonding for $20,000 for a sewerage system is being considered.

Union City, Tenn.—A sewerage system is proposed at a cost of $30,000. W. L. Gardner, mayor.

Binghamton, N. Y.—The Binghamton Filling company has petitioned council for a sewer in Griswold-st.

Perry, N. Y.—Estimates for a complete sewerage system will be made by Knight & Hopkins, of Rome, N. Y.

Buffalo, N. Y.—A trunk sewer in Virginia-st., at a cost of $48,000, has been favorably reported upon.

Chicopee, Mass.—City Engineer Cobb estimates the cost of building 2,700 feet of five-foot sewer at $19,000.

Santa Monica, Cal.—The city engineer has been directed to ask for bids for a pumping plant for the beach sewer.

Denver, Col.—Plans and specifications for a sewer district in North Denver have been ordered prepared.

Greenville, Ia.—Plans and specifications for a storm water sewerage system are about completed. City Engineer Lewis.

Galion, O.—The board of health is investigating sewage disposal plants and urges the council to take immediate action.

Boston, Mass.—A resolution appropriating $75,000 for sewers in Ward No. 2 has been introduced in the council.

Columbia, Mo.—Bonds have been voted for a trunk sewer. J. C. Gillespie, mayor; Hiram Phillips, St. Louis, constructing engineer.

Cambridge, Mass.—The question of appropriating $42,000 for building sewers is being considered by the finance committee.

Eaton, O.—The question of engaging an engineer to advise with the council regarding a sewerage system is being considered.

Fulton, N. Y.—The sewer commission voted, June 15, to make extensions to the sewerage system in a number of streets.

Syracuse, N. Y.—Ordinances have been introduced declaring intention to build sewers in practically every street in the Third ward.

Schnectady, N. Y.—Resolutions have been adopted for building a sewer in Dulett-st. and for extending the Brandywine-ave. sewer.

Scranton, Pa.—The common council passed the $273,205.80 bond ordinance, June 14, for the city's share of the cost of sewers.

Haverhill, Mass.—The question of building a sewerage system for the Kenoza Lake water shed is being considered by the council.

Omaha, Neb.—The question of the Saddle Creek sewer has been taken up by City Attorney Rosewater and Councilman Trostler.

Crawfordsville, Ind.—The city council has voted to build a complete sewerage system and has ordered 3½ mls. to be constructed at once.

Holland, Mich.—The council has adopted sewer plans and will call a public meeting for July 9, when the proposition will be explained to the citizens.

The question of issuing bonds for sewerage systems will be voted on as follows: Wyandotte, Mich.; Connellsville, Pa., July 6; Oklahoma City, Ok.; Canonsburg, Pa.

The question of issuing bonds for sewerage systems has been finally voted on at the following places: Xenia, O., $30,000; Merced, Cal., $40,000.

Danville, Ky.—The report of Alvord & Shields of Chicago on the proposed sewerage system has been submitted to the city council. The estimated cost is $23,000.

Jersey City, N. J.—The State Sewerage Commission considered and approved plans June 25 for a sewerage system for the Rahway Reformatory. The plans were prepared by Jas. Owen of Newark.

Summit, N. J.—A resolution has been introduced in the council providing for the issue of $135,000 bonds for the joint sewer, as follows: Sewer, $80,000; laterals, $40,000; to purchase lands and erect new fire houses, $10,000.

Marshalltown, Ia.—Bids were received June 14 for the erection of a sewage disposal plant, ranging from $23,000 to $146,000. The council decided to take no action at present, but will visit the sewage disposal plant at Mendota, Ill.

Pittsfield, Mass.—A sewage disposal system for this city, including pumping stations and fitting up the proposed Russell Park, has been advised by John N. McClintock, president and manager of the American Sewage Disposal company, of Boston, who offers to put it in for $100,000.

CONTRACTS AWARDED.

Brooklyn, N. Y.—The contract for the Huron-st. sewer was awarded to James Kelly for $140,020.

Cleveland, O.—The contract for a sewer in Erie-st. was awarded to L. H. Cook for $100,874.

Glenwood Springs, Col.—J. A. I. Clauden secured the contract for building three sewers in this city.

Lake Bluff, Ill.—The contract for a sewerage system was awarded to Harding & Nelson of Racine for $30,000.

Wahpeton, N. D.—The contract for a new sewerage system was awarded to James Kennedy of Fargo for $19,992.

Albany, N. Y.—Dollard & Holler secured the contract for repairs to the Fox creek sewer June 15 for $10,160.

Philadelphia, Pa.—R. J. Sullivan was awarded the contract for a sewer in Eleventh-st. for $52,000 June 13.

Cincinnati, O.—The contract for a sewer in Bennett run was awarded June 15 to J. Delaney for $12,874.65.

Paris, Ill.—The contract for sewers was awarded to Wolf, Maupin & Curdie of Alton, Ill., for $10,105.69.

Omaha, Neb.—The contract for the remainder of the sewer in North Omaha has been awarded to Black & Laird for $55,000.

Braddock, Pa.—The contract for a sewer in North-ave., North Braddock, was awarded June 11 to John Dell for $2,125.

Madelia, Minn.—The lowest bid submitted for building a sewer was that of Landkaimer & McCall, which was $3,683.

Sioux City, Ia.—The contract for building a storm sewer at Greenville was

awarded to Charles E. Lane, of this city, for $4,700.

Bristol, R. I.—Frank E. Shaw, of Providence, secured the contract for building sewers in several streets for about $30,000.

Normal, Ill.—Wolf, Maupin & Curdie, of Alton, Ill., secured the contract, June 11, for a sewer in Ash and Linden-sts. for $6,103.26.

Jamestown, N. Y.—Mahoney Bros. & Gardner, of Buffalo, were awarded the contract for extending the sewers of this city for $20,400.46.

Springfield, O.—Ulrick & Williams secured sewer contracts, June 11, as follows: Clifton-st., $4,199.50. Taylor and Clifton-sts., $1,338.

McKeesport, Pa.—The contract for the extension of the Irwin-st. sewer was awarded to Keeling & Ridge, of Philadelphia, for $12,455.

Independence, Mo.—The contract for constructing sewer district No. 12 has been awarded to Matt & Roberts, of this city, for about $2,000.

Syracuse, N. Y.—The contract for building a sewerage system at the penitentiary was awarded to Gorman Bros., or Jamesville, for $4,816.

Bayonne, N. J.—Eagan & Hareld, of Jersey City, secured contracts for sewers in this city, June 5, as follows: Fifty-second-st., $2,081.24; Firty-third-st., $2,167.23.

Dorranceton, Pa.—Bids were received, June 18, for sewers in the Fourth ward. The bids ranged from $5,787.11, by B. G. Koon, to $12,000. Action on the bids was deferred.

Wilkesbarre, Pa.—Contracts for sewers in two divisions have been awarded as follows: First division, construction, D. M. Rosser, $3,685; pipe and fittings, George McAlanney, $3,949; second division, construction, Gibbons & Co., $4,965; pipe and fittings, Hutchins & Co., $1,211.

East Hartford, Conn.—Bids were received from twelve contractors, June 19, for the construction of nine miles of sewers, ranging in price from $60,000 to $85,000. The Hartford Paving and Construction company is thought to be the lowest bidder.

Detroit, Mich.—Contracts for public sewers have been awarded as follows: Dubois-st., from Larned to Maple, Thomas Shiehan & Co., $29,362.05; Van Dyke-ave., from Grazer to Lambert, J. A. Mercier, $6,099.40; Cameron-ave., from Philadelphia to Holbrook, John James, $4,729.20.

WATER-WORKS.

CONTRACTS TO BE LET.

Wyoming, O.—Bids are asked until July 11 for a 1,500,000-gallon pumping engine.

Detroit, Mich.—Bids are asked until July 12 for one or two engines of 25,000,00 gallons each in twenty-four hours. Water Board.

Washington, D. C.—Bids are asked until July 7 for constructing two gate houses at the Brightwood reservoir. H. B. F. MacFarland, chmn. dist. comrs.

Neenah, Wis.—(Special)—Sealed bids are asked until July 2 for the construction of a well at the water works pumping station. I. E. Johnson, supt. bd. W. W. comrs.

Washington, D. C.—Sealed bids are asked until July 7 for furnishing 10,000 lin. ft. 12 in., 5,000 ft. 4 in. and 3,000 ft. 3 in. cast iron water pipe. H. B. F. McFarland, chmn. dist. com'rs.

St Paul, Minn.—Bids are asked until July 9 for constructing the structure to suspend a 16-in. cast iron water pipe under the roadway of the Wabasha-st. bridge. John Caulfield, sec'y Water Com'rs.

East Cleveland, O.—Bids are asked until July 7 for the water works extension, consisting of motors and pumps; steel tower, 40x30 ft., tower foundation; water pipe and specials; laying water pipe. Walter P. Rice Engineering company, Cleveland, O.

Cincinnati, O.—Sealed bids are asked until July 3 for the construction of a tunnel and shaft for supply water to the Western Pumping station. Bids will be received July 6 for a deep well pump of 1,000 U. S. gals. per minute. Aug. Hermann, pres't Bd. Trustees, W. W. Com'rs.

CONTEMPLATED WORK.

Silver Creek, N. Y.—Water meters will be introduced.

Jackson, Mich.—Plans will be prepared for a reserve water supply for this city.

Ionia, Mich.—About $6,000 will be expended in improving the water works system.

Leadville, Col.—The erection of a municipal water works system is proposed.

Troy, N. Y.—Surveys are being made for an additional water supply. Edw. R. Cary, cy. engr.

Rock Island, Ill.—Bids will be asked soon for a 1,500,000 gal. pumping engine.

Hintonburg, Ont.—This city will expend $28,500 in extending the water works system.

Cass Lake, Minn.—A franchise will be granted for a water works and electric light plant.

Providence, R. I.—The special committee recommends the adoption of a mechanical filter.

Elyria, O.—The estimated cost of a water works system with Lake Erie as the source of supply is $275,000.

Topeka, Kas.—The plans for the proposed new water works system contemplate a plant at a cost of $457,000.

Salt Lake City, Utah.—The question of issuing $250,000 water works improvement bonds will be voted on July 16.

Ottumwa, Ia.—An expert engineer will probably be engaged to make estimates and specifications for a new water plant.

Dover, N. J.—C. C. Vermuele, New York City, has been engaged as consulting engineer for the proposed new water supply.

Monmouth, Ill.—Bids were received June 14 for the extension of the water works plant, but, being considered too high, no contract was made.

Dubuque, Ia.—Water Trustees Heer and Ryder visited Quincy, Ill., June 14, to examine the filter plant in operation in that city.

Ouray, Colo.—Plans and specifications prepared by Hiram Phillips, C. E., of St. Louis, have been adopted for improving the water works system.

Lancaster, N. Y.—The board of village trustees have asked for sealed bids for making the plans and specifications for a water works system for this village.

Peekskill, N. Y.—The board of water commissioners has decided to lay 300 ft. of 6

inch main in Park-st., and 650 ft. of 6 inch main in Lincoln Terrace.

Sheffield, Ala.—An ordinance has been passed providing for the issue of $75,000 bonds for the construction and maintenance of a municipal water works plant.

Laurel, Md.—The water board has selected Messrs. Hill, Quick and Allen as engineers to construct the works provided their plans are approved by a consulting engineer.

The extension of water mains is proposed at the following places: Winona, Minn.; Horton, Kas.; Seattle, Wash.; Rutland, Mass.; Toledo, O.; Manistee, Mich.; Bancroft, Neb.; Somersworth, N. H.; Lansingburgh, N. Y.; Orange, N. J.

The question of issuing water works bonds has been favorably voted on at the following places: Algonac, Mich.; Brown's Valley, Minn.; Sault Ste. Marie, Mich.; Englishtown, N. J., Elyria, O.; Barberton, O.; Waynesville, O.; Robinson, Ill.; Oakland, Ill.; Ruston, La.; Sisterville, S. D.

Pittsburg, Pa.—The common and select councils have passed a resolution directing the department of public works to prepare plans and specifications as speedily as possible for a slow sand filtration plant in accordance with the recommendation of the filtration commission.

The construction of water works systems is contemplated at the following places: Braddock, Pa., July 17, Brewster, Minn.; White Rocks, S. D.; De Senet, S. D.; Gary, S. D.; Maryville, Tenn.; Lewisburg, Tenn.; Hopkins, Minn.; Clinton, Ind.; Waldoboro, Me.; Rowlesburg, W. Va.; Hallock, Minn.; Nunda, Ill.; Marshall, Ind.; Sidney, Neb.; Hawkesburg, Ont.; New Castle, Del.

BRIDGES.

Vincennes, Ind.—Bids are asked until Aug. 7 for three iron bridges.

Cedar Rapids, Ia.—Plans for the A-ave. viaduct are being prepared by City Engineer Meredith.

Albion, Mich.—The question of building a new bridge across Kalamazoo river will be voted on July 2.

Egan, S. D.—Bids are asked until July 5 for a bridge across Skunk creek in Coleman twp. C. D. Sanders, co. audt.

Seymour, Ind.—Sealed bids are asked until July 6 for building a number of bridges. John H. Durment, co. audt.

Monticello, Miss.—Bids are asked until July 5 for a steel drawbridge across Pearl river. W. H. Speights.

Cleveland, O.—The Wrought Iron Bridge company, Canton, O., has been awarded the contract for the Willet-st. bridge.

Silver Creek, N. Y.—The question of building a new bridge over Silver creek on E. Dunkirk-st. is being considered.

New Castle, Ind.—Sealed bids are asked until July 13 for building eight steel bridges. John W. Whitworth, chmn. co. com'rs.

Davenport, Wash.—Bids are asked until July 9 for a new wagon bridge across the Spokane river. J. W. Anderson, co. audt.

Kirksville, Mo.—The contract will be let at public outcry July 3 for a new bridge across Sugar creek, in Belton twp. Tyler Paine, co. surv.

Woonsocket, R. I.—An ordinance has been passed appropriating $5,500 for the Kendrick-ave. bridge which will be built this year.

Chicago, Ill.—Sealed bids are asked until July 11 for a bridge across the Chicago river at Canal-st. William Boldenweck, pres't bd. trustees.

Belleville, Wis.—The Wrought Iron Bridge Co., Canton, O., has been awarded the contract for a new bridge across Sugar river for $2,350.

Newport News, Va.—Bids are asked until July 7 for a steel viaduct over the Chesapeake & Ohio railroad track at Twenty-eighth-st. E. I. Ford, chmn. bd. com.

New York City—Bids are asked until July 3 for a viaduct carrying Riverside drive over Ninety-sixth-st. Geo. C. Clausen, chmn. com'ns parks.

Saginaw, Mich.—Sealed bids are asked until July 6 for furnishing labor and material for the equipment of the swing span of the Court-st. bridge. Alfred Davies, clk. B. P. W.

Geneva, Ind.—(Special).—Bids were received June 8 for a bridge across the Wabash river, as follows: Wabash Bridge Co., Wabash, Ind., $1,950.00; Bellefontaine Bridge Co., Bellefontaine, O., $1,794.82; Variety Bridge & Iron works, Cleveland, O., $1,992.00; Attica Bridge Co., Attica, Ind., $1,798.00; Indianapolis Bridge & Iron works, Indianapolis, Ind., $1,820.00; Massilon Bridge Co., Massilon, O., $1,785.00; Brackett Bridge Co., Cincinnati, O., $1,778.00; Indiana Bridge Co., Muncie, Ind., $1,805.00; New Castle Bridge Co., New Castle, Ind., $1,510.00; King Bridge Co., Cleveland, O., $1,800.00; New Columbus Bridge Co., New Columbus, O., $1,924.00; Lafayette Bridge Co., Lafayette, Ind., $1,793.00; Champion Bridge Co., Wilmington, O., $2,000.00; Canton Bridge Co., Canton, O., $1,741.00; Toledo Bridge Co., Toledo, O., $1,900.00.

PARKS.

East Orange, N. J.—A public parkway is proposed.

Rhinelander, Wis.—This town has voted to establish a park.

Rockford, Ill.—Mayor Brown has proposed a river park.

Muncie, Ind.—The question of public parks was discussed by the Commercial Club June 20.

STREET LIGHTING.

Loveland, Colo.—Plans have been adopted for the proposed electric light plant.

Carlinsville, Ill.—The contract for lighting the streets was awarded June 4 to W. L. Mounts.

Great Falls, Mont.—The question of granting a franchise to a new company is being agitated.

Favorably voted on: Waynesville, O.; Algonac, Mich.; River Falls, Wis.; South Haven, Mich.

Peoria, Ill.—The contract for lighting the city was awarded to George E. Macomber June 19, at $65 a light.

Lawrenceburg, Ind.—Bids are asked until Aug. 1 for electric lighting. Joseph F. Frazer, cy. clk.

Chaska, Minn.—Bids are asked until July 15 for an electric light plant. H. H. Strobeck, cy. clk.

New Washington, O.—A. P. Miller is reported as interested in the construction of an electric light plant.

Milan, Mich.—The contract for lighting the streets with electric lights has been awarded to W. P. Lampin.

Darby, Pa.—Bids are asked until July 1 for lighting the streets for one year. Chas. E. Drewes, chmn. light com.

Osgood, Ind.—Plans and specifications for an electric light plant are being made by James B. Nelson of Indianapolis.

Milwaukee, Wis.—Plans are being considered for an electric light plant in the chamber of commerce and Mitchell building.

Waterville, N. Y.—The question of increasing the number of electric lights in this village has been favorably voted on.

Riverside, Cal.—Sealed bids are asked until July 17 for the equipment for a steam power and electrical plant. C. R. Stubbins, cy. clk.

Rutland, Ill.—An ordinance has been passed granting a 20-year franchise to Samuel Milliken of Walnut to construct and operate an electric light plant.

The question of issuing electric light bonds will be voted on at the following places: Coffeyville, Kas.; Chambersburg, Pa.; St. Mary's, Ont.

Walla Walla, Wash.—A franchise has been granted D. B. Crocker, Gilbert Hunt and A. K. Dice for a light and power plant to be constructed and operated in this city.

Leicester, Mass.—A 5-year contract has been made with the Rawson Light and Power company at $20 per light per year, and to light the town hall at 1¼ cents a light per year.

South Orange, N. J.—The contract for street lighting was awarded to the People's Light and Power company as follows: Two hundred lamps of 32 c. p. each, for 1 yr., $16; 2 yrs., $15.50; 5 yrs, $15.

Electric light plants are contemplated at the following places: North Platte, Neb.; Wolfe City, Tex.; Windfall, Ind.; Charlestown, Ky.; Marshalltown, Ia.; Bedford, Que.; Fort Maitland, Ont.; Olin, Ia.

Camden, N. J.—The Camden Gas Light company secured the contract for furnishing gas lights for one year in the old portion of the city, and the East Side Gas company for five years in the Eleventh and Twelfth wards.

San Francisco, Cal.—A plan has been submitted to install an electric lighting plant furnishing the city with more lights than are now used for $275,000 a year and at the end of twenty years to turn the plant over to the city.

Racine, Wis.—The contract for lighting this city for five years was awarded to the Milwaukee Electric Lighting company at $54 each for 1 o'clock arch lights, $72 for all-night lights and $18 each for incandescent light in the alleys.

Tiffin, O.—(Special)—Sealed bids will be received until July 30 for lighting the streets of this city. Bids are to be on the basis of 100 arc lights of 2,000 c. p., or 250 arc lights of 51,200 c. p. each. Bids will also be received for lighting the streets with the latest improved gas lights. J. B. Ehrenfried, cy. clk.

Columbus, Ga.—(Special)—R. S. Johnson, C. E., says the city council on June 6th let the contract for street lighting to the Columbus R. R. Co. (who also operate the lighting plant), at $50 per light, per year, for a term of three years, beginning on Jan. 1st, 1900. This is a reduction of $35 per light per year from what the same company is now furnishing the lights for.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Newark, N. J.—The method of street cleaning in this city is not satisfactory.

Hamburg, N. Y.—The citizens are agitating the question of street sprinkling.

Muncie, Ind.—The garbage committee has been authorized to purchase a new wagon.

Akron, O.—Ordinances have been passed for sprinkling several streets. Chas. I. Isbell, clk.

Grand Forks, N. D.—A report has been adopted to purchase a new 1,000 gal. sprinkler.

Waterloo, N. Y.—Wm. King secured the contract for the removal of garbage for $2,475.

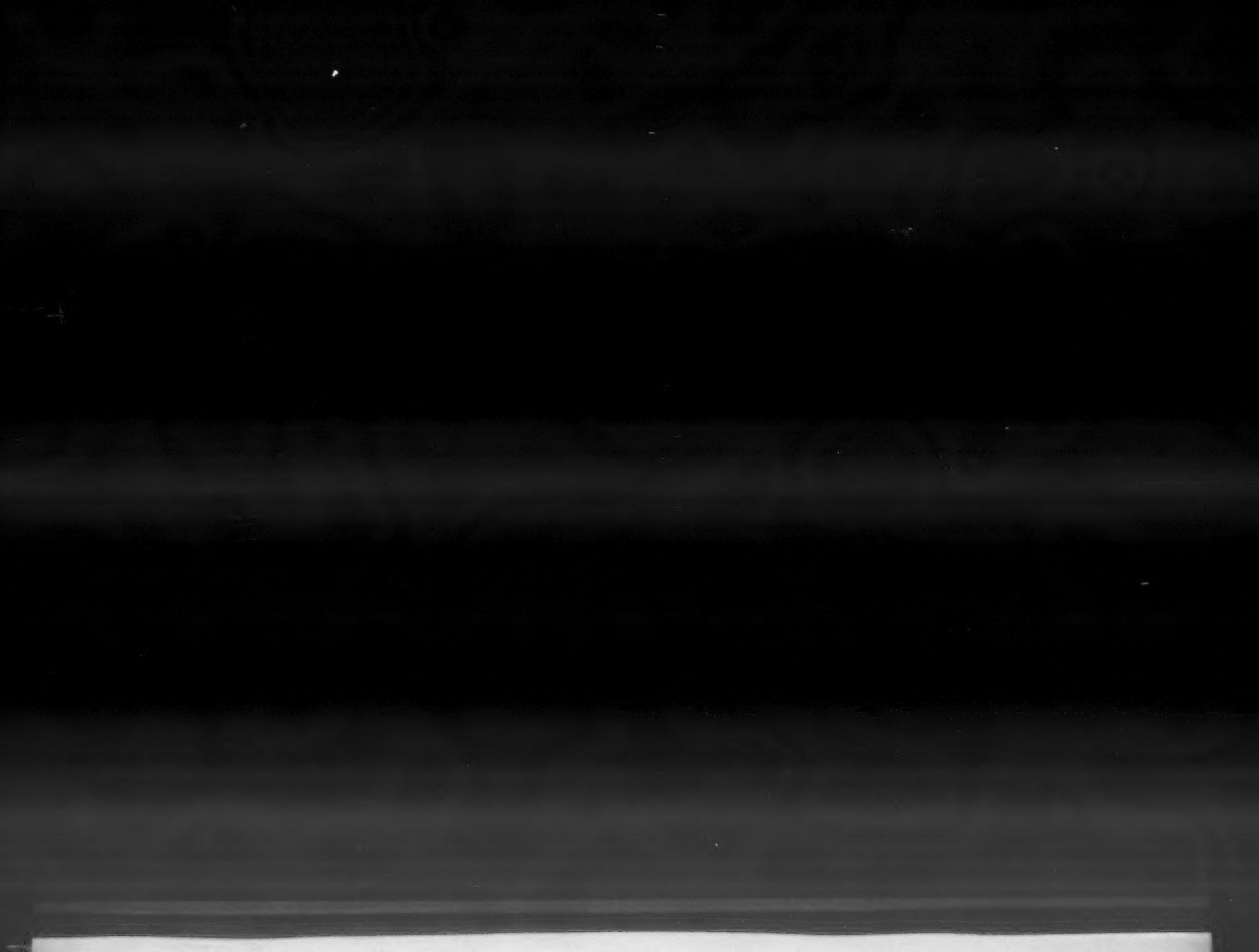
Grand Forks, N. D.—Bids are asked until July 2 for the removal of garbage. F. A. Brown, co. audt.

San Antonio, Tex.—The purchase of a new electric street sprinkler is contemplated. Mayor Hicks.

San Francisco, Cal—The contract for sprinkling the public streets was awarded, June 8, to the City Street Improvement company at 2½ cts. per 1,000 lin. ft.

Garbarge crematories are contemplated at the following places: Kalamazoo, Mich.; Bangor, Me.; New Haven, Conn.; Newport News, Va.; Salem, O., Toledo, O.; Centerville, Ia.; San Jose, Cal.

Utica, N. Y.—The contract for the removal of ashes and rubbish for two years and five months has been awarded to Charles I. Williams at $9,600 a year.

Utica, N. Y.—The contract for sweeping the paved streets of this city with both machine and hand labor for a term of two years and four months was awarded to the Capital Sweeping company at $40,608 a year.

Washington, D. C.—The contract for the collection and disposal of garbage, dead animals, night soil, ashes and miscellaneous refuse has been awarded to N. H. Chamberlain of Detroit, Mich. The garbage, dead animals, etc., will be collected, removed from the city and treated in a reduction plant, for $51,660 a year. The collection and disposal of other wastes was awarded to R. B. Rusk of Washington, as follows: Night soil, $17,000 per annum; ashes, $29,979; miscellaneous, $8,000; making a total of $64,979 for these contracts and $106,579 per annum for these and garbage and dead animals in addition.